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Publication date:
2014

Document Version
Publisher's PDF, also known as Version of record

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Report 39/2014

NIFU

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Report	39/2014
Published by	Nordic Institute for Studies in Innovation, Research and Education (NIFU)
Address	P.O. Box 5183 Majorstuen, N-0302 Oslo. Office address: Wergelandsveien 7, N-0167 Oslo
Project No.	12820295
Customer	Norges forskningsråd
Address	Drammensveien 288, 0283 Oslo
Print	Link Grafisk
ISBN	978-82-327-0045-5
ISSN	1892-2597 (online)

www.nifu.no

Preface

This report gives results of an analysis of effects of demonstration projects in transition processes to sustainable energy and transport in the Scandinavian countries.

The report is a result of the research project “Role of demonstration projects in innovation: transition to sustainable energy and transport” (2013–2014). It was funded by the Forfi programme at the Research Council of Norway. It was led by Antje Klitkou at NIFU. The project was based on a collaboration with the Technical University of Denmark and CIRCLE at Lund University.

Antje Klitkou, NIFU wrote chapter 1–4, 6 and 7. Arne Fevolden, NIFU wrote chapter 5. Mads Borup from Denmark’s Technical University and Alexandra Nikoleris from CIRCLE at Lund University conducted the interviews in Denmark and Sweden and gave feedback on the draft report.

Oslo, 19. December 2014

Sveinung Skule Director	Espen Solberg Head of Research

Contents

Summary

This report gives results of an analysis of effects of demonstration projects in transition processes to sustainable energy and transport in the Scandinavian countries on the development of knowledge networks and interaction with users, which we assess as two of the main outcomes of demonstration projects. Public funding of demonstration and trial projects are relatively well-developed policy instruments for the transition towards more sustainable energy and transport systems in the Scandinavian countries. However, the three countries have used such instruments to a different extent and with different priorities.

In this report we concentrate on the formation of broad and aligned networks and collaboration patterns, including the involvement of users, both industrial users and customers, and analyse how public agencies prioritise networking and user involvement in their funding programmes of demonstration and trial projects.

We identified 433 demonstration projects starting in the period 2002–12, in Denmark 224 projects, in Norway 107 projects and in Sweden 102 projects. Almost one fourth of the projects targeted road transport solutions, mainly electrical mobility and biofuel/biogas.

The analysis of the project aims revealed rather different priorities between the three countries. Main differences have been identified for the following aims: facilitate learning, formation of knowledge networks, institutional embedding, public acceptance, commercial feasibility and reduction of costs. We concentrated our analysis on the formation of knowledge networks.

We identified 354 connected nodes in the Danish projects, 296 in the Norwegian projects and 170 in the Swedish projects. The comparative analysis of the network patterns revealed clear differences between the three countries regarding the number of projects, number of actors, share of collaborative projects, network density, fragmentation and collaboration with international partners.

International collaboration relations show an unbalanced pattern. Norway has a higher degree of collaboration with foreign organisations, compared to both Sweden and Denmark. Collaboration with Norwegian partners in Swedish or Danish projects is almost not existing, while the opposite is the case for the Norwegian projects.

The comparative analysis of prioritisation of collaboration by the funding programmes has shown some clear similarities, but also some differences. The following issues have been discussed: (1) the influence of the national innovation system on the national collaboration patterns, (2) the balance between sustainability and competitiveness targets, (3) the control of significant intellectual property, (4) user involvement, and (5) the involvement of interest organisations and local authorities or municipalities.

National collaboration patterns are different due to different national innovation systems, such as the balance between universities and R&D institutes, the role of NGOs, the existence of large R&D-based incumbents or the dominance of SMEs. However, the different involvement of foreign partners seems to be the result of a political prioritisation or by different access to funding means.

The Scandinavian funding programmes for demonstration and trial projects for sustainable energy and transport solutions interact with the respective R&D funding programmes. In some cases they are even a part of such programmes. There is also a need for analysing the funding programmes for demonstration and trial projects in interaction with other policy instruments, such as fiscal instruments. This has not been in the focus of this report.

National funding programmes for demonstration and trial projects for sustainable energy and transport solutions have to balance between two priorities: (1) supporting the transition towards more sustainable solutions and (2) strengthening the competitiveness of national actors. However, the focus on competitiveness is not that strong in the Danish and Swedish programmes as in some of the Norwegian programmes, but there are also differences between the Norwegian support schemes.

User involvement is central to all of the funding programmes. However, there are differences related to who the users can be, i.e. the end-users of EVs can be individual customers or fleet owners, the user of a new energy technology can be an electricity facility or a company which is integrating the technology in its operations etc. Therefore it is difficult to draw general conclusions for all types of users.

Scandinavian demonstration projects are often based on collaboration between firms and R&D organisations, but the networks also include other types of societal actors, such as NGOs and municipal organisations. In all three countries, firms are rather central in the networks, while the role of universities is more central in Denmark and Sweden compared to Norway where R&D institutes play a decisive role. Interesting is the central position of municipal organisations in both Norway and Sweden, and the strong involvement of a NGO in Norway. This NGO initiated several demonstration projects.

Pilot, demonstration and test projects frequently involve collaboration between a quite diverse set of actors. Some of them are private companies interested in exploring commercial opportunities, others are research institutions interested in carrying out novel research and others still are non-governmental organisations (NGO) interested in pursuing certain political goals. In addition to differences in goals, these organisations often vary in size and have different organisational cultures and decision-making processes. Some of them have worked together previously and have an established relationship, while others meet for the first time during the project. These and other factors affect how well the different actors work together and whether the pilot, demonstration or test project becomes successful.

We have seen from the qualitative analysis that there are several factors that affect the collaboration in pilot, demonstration and test projects. In general, similarities between the participants are favourable. Both similarities in size, organisational culture and educational background were considered to be favourable by most participants. Nevertheless, being dissimilar in some aspects (educational background) does not necessarily hamper the collaboration if the participants could find common ground on other aspects (organisational culture). Generally, most participants found ways of combining different goals. Nevertheless, in some instances the participants had to spend considerable effort to find "common ground," and move the project forward.

What are the policy implications? We want to highlight the following policy implications for the funding programmes. The funding programmes should:

- support a number of projects and not just one big project to facilitate the demonstration of several alternative solutions;
- facilitate learning across projects to contribute to knowledge sharing;

- address the need of companies to retain the intellectual property rights in balance with the sustainability targets of the programmes;
- facilitate – when relevant – the dialogue with non-governmental organisations;
- target more institutional embedding of new technological solutions to improve learning about and diffusion of the technology;
- strengthen private-public collaboration, especially at the local level;
- coordinate their efforts at the national level to secure optimal conditions for the supported projects; and
- coordinate their efforts across national borders to achieve stronger and more successful projects and collaboration across the Scandinavian borders.

1 Introduction

We face today important challenges related to the environmental impact of the transport sector. In Norway, the annual energy consumption in the transport sector is about 57 TWh/year or 26 percent of the total energy consumption, based on 2011 values (Bendiksen, 2014:13f. and table 1.0). 72 percent of this consumption happens in road transport and 98 percent of the road transport was fuelled by fossil fuels (ibid.). Therefore, the introduction of sustainable solutions in the energy and road transport system is so important.

In the transition towards sustainable energy and transport systems the development and up-scaling of niche experiments plays a decisive role. The problems of the incumbent fossil-based socio-technical regime increase possibilities for niche development, but this is not sufficient to succeed. Following processes have been highlighted in the transition literature as decisive for successful niche development: facilitating learning processes, the formation of broad and aligned networks and institutional embedding, voicing and shaping of expectations and visions, and the development of complementary technologies and infrastructures (Hoogma et al., 2002:30; Raven, 2005). We concentrate here especially on the formation of broad and aligned networks and collaboration patterns, including the involvement of users, both industrial users and customers, and analyse how public agencies prioritise networking and user involvement in their funding programmes of demonstration and trial projects.

Demonstration projects target core processes and key instruments needed to facilitate the alignment of promising new technologies with societal conditions. Such alignment is necessary for the successful adoption of radical new technology and if the development and diffusion of emergent technologies, in a transition to more sustainable energy and transport systems, is to be sustained and accelerated. Demonstration projects have proven to be an important instrument for policy-makers, researchers and firms in helping to reduce uncertainty and learn about the acceptance, desirability and adaptation of new technology in society. Interaction with societal actors, monitoring experiences with governance of such projects and policy learning are all important issues (Klitkou et al., 2013:21ff.).

This report gives results of an analysis of effects of demonstration projects in transition processes to sustainable energy and transport in the Scandinavian countries on the development of knowledge networks and interaction with users, which we assess as two of the main outcomes of demonstration projects. The paper is based on a research project which includes the following steps: (1) a state of the art study on the role of demonstration projects in innovation and transition processes (Klitkou et al., 2013); (2) the compilation of a database over Scandinavian demonstration and trial projects (Dannemand Andersen et al., 2014b); (3) a social network analysis of collaboration patterns in the networks; (4) a survey about the results and learning effects of those projects (Olsen, 2014); and (5) a number of focus groups and interviews on the outcomes, effects and impact of demonstration and trial projects. Here we present results mainly from the three first steps and will add as well some insights from the interviews and the survey.

The main purpose of this report is the analysis of: (1) the role of public funded demonstration projects for the changes of the knowledge networks of project participants over time, (2) the prioritisation of networking by the programmes funding the projects, and (3) the reflections of project managers and project participants on their collaborative experiences.

The report is structured as following (authorship is given in parentheses): After this introduction, in chapter 2 (Klitkou), we draw up the theoretical background of this analysis. In chapter 3 (Klitkou), we reflect on the applied methodology and in chapter 4 (Klitkou), we present the results of the social network analysis. In chapter 5 (Fevolden), we analyse the reflections of project managers and project participants on their collaborative experiences. In chapter 6 (Borup, Klitkou, Nikoleris), we will discuss results of the focus groups and interviews on the prioritisation of collaboration by the programmes funding the demonstration projects. In chapter 7 (all four authors), we draw our conclusions.

2 Theoretical background

In this section, we discuss the theoretical background for the importance of collaboration and networking for demonstration projects. Here we draw mainly on the literature of the transition theory and strategic niche management as presented in our state-of-the-art-paper on the role of demonstration projects in innovation (Klitkou et al., 2013) and to some extent innovation studies.

2.1 Niches and experiments

The Strategic Niche Management approach has been developed to address niche processes and to some degree to provide policymakers a tool for supporting niche development (Hoogma et al., 2002:29). Kemp, Schot and Hoogma (1998:186) define Strategic Niche Management as:

> "the creation, development and controlled phase-out of protected spaces for the development and use of promising technologies by means of experimentation, with the aim of (1) learning about the desirability of the new technology and (2) enhancing the further development and the rate of application of the new technology."

Policy intervention in socio-technical systems is not only relevant for the selection of niche technologies through experimentation. Policy interventions also include "the articulation of expectations and visions, network formation, resource allocation, favouring open-ended learning processes, and supporting technology diffusion (up-scaling)" (Coenen and Díaz Lopez, 2010:1156).

Hoogma (2002:67) between four types of experiments relevant for creating niches: (1) *explorative experiments* at early stages of learning to help define problems, explore user preferences and possibilities for changing the innovation, and learn how future experiments should be set up; (2) *pilot experiments* to raise public and industrial awareness, stimulate debate and open policymaking, test the applicability of innovations in locations with similar conditions or to test the feasibility and acceptability of innovations in new environments; and (3) *demonstration experiments* to "show potential adopters how they may benefit from the innovations. They may either be the follow-up of explorative or pilot experiments, or be designed specifically to promote the adoption of an innovation" (Raven, 2005:38); (4) *replication or dissemination experiments* to disseminate tested methods, techniques or models through replication, which involves full-scale implementation of a technology.

Raven emphasises that experiments and niches are not the same. In niches the "local experiments and practices are compared, lessons and expectations are transferred between locations, and delocalised general knowledge of the technology in question is formulated" (Raven, 2005:38). And he highlights that experiments reflect three main evolutionary and sociological aspects of niches:

- Experiments bridge the gap between variation and selection environments: "Interaction between technology actors (firms, research institutes), societal actors (users, environmental groups), and regulating actors (public authorities) may contribute to integrating the concerns of different groups into the design" (Raven, 2005:38);
- Experiments are protected from some of the rules that make up the dominant socio-technical regime: public authorities give subsidies for lowering risks for involved firms and firms may decide to test the feasibility of a technology in a pilot plant because of strategic decisions;
- Experiments are often characterised by limited structuration and high uncertainty, especially in early stages of experimentation.

An example for the differences between experiments and niches in a Norwegian transportation context is the introduction of the worldwide first electrical ferry in Hordaland in 2014 as a new experiment with sustainable transport solutions and the deployment of and broad policy support for battery electrical vehicles as a market niche.

Instability of the socio-technical regime increases opportunities for niche development, which can result in increased niche size. Raven distinguishes between three possible avenues: (1) regime instability can create local opportunities for experiments and niche actors develop expectations linked to regime instability; (2) with a decreasing stability of the regime the regime actors become interested in the niche because of promising options for the future; and (3) in the case of very high instability of the regime a niche can be adopted by the regime as a problem solver, but for this a sense of urgency has to become prominent in political visions and agreements (Raven, 2005:260).

However, the instability of the regime is not sufficient for niches to succeed. The quality of the niche processes is decisive. Following processes have been highlighted in the literature as decisive for successful niche development: facilitating learning processes, the formation of broad and aligned networks and institutional embedding, voicing and shaping of expectations and visions, and the development of complementary technologies and infrastructures (Hoogma et al., 2002:30; Raven, 2005).

Hoogma et al. highlight the following aspects of learning as relevant for niches: (1) design specifications of technical development and infrastructure; (2) development of the user context, including user characteristics, their demands and their barriers to use the new technology; (3) the societal, safety and environmental impact of the new technology; (4) required industrial development, including production and maintenance networks to facilitate diffusion of the new technology; and (5) government role and regulatory framework in the introduction process, and possible incentives to stimulate adoption (Hoogma et al., 2002:28).

Hoogma et al. identify three aspects of *institutional embedding* in niche development: (1) embedding includes the development of complementary technologies and the necessary infrastructure, (2) institutional embedding produces widely shared, specific and credible expectations which are supported by facts and demonstration successes, and (3) embedding ensures to include a broad array of actors aligned in support of the new technology – aligned network of producers, users, third parties, esp. government agencies (Hoogma et al., 2002:29).

Coenen et al. emphasise the need for analysing institutional embedding in the geographical context for explaining "the extent to which and in what ways geographically uneven transition processes are shaped and mediated by institutional structures" (Coenen et al., 2012:973).

2.2 Broad social networks

Raven highlights that broad social networks include producers, users, regulators, societal groups and that these networks carry expectations and articulate new demands and requirements (Raven, 2005). There are two characteristics of networks which are important for niche development: (1) the composition of the network and (2) the alignment of actors' activities (Raven, 2005:40f.).

Regarding the *composition of the network,* actors have to be included who are willing to invest in maintaining or expanding the niche. These may often be large established firms, which support the incumbent technology regime, and there is therefore a risk for inertia and path extension. A dominance of established firms can lead to dominance of incremental innovations. The network should also involve actors who have no strong ties with the existing regime, but these often have limited resource mobilisation potential and may not be able to maintain the niche over long time. Important is the active involvement of users, both industrial users and costumers, but also the involvement of non-user groups that are affected by the impact of the technology (neighbouring residents, environmental groups, concerned citizens) (Verheul and Vergragt, 1995). Raven points out that traditionally SNM literature has focus on users for generating second order learning processes, but he emphasises that involvement of non-industrial users is not always that relevant for industrial niche projects. Here it might be more relevant to involve environmental organisations or concerned citizens, for instance representing the neighbours of an experiment. "Including these groups at an early phase of experimentation can result in the inclusion of their concerns in the innovation process and prevent societal resistance in later phases, through early adjustment of the design" (Raven, 2005:257). It is also a possibility that such actors can participate in the experiments, taking part in the organisation of the plant.

The *alignment of actors' activities* "refers to the degree to which actors' strategies, expectations, beliefs, practices, visions, and so on go in the same direction, run parallel" (Raven, 2005:40). Rip understands alignment as a concept "that indicates the mutual and well-functioning adjustment" of strategies and visions at the network level (Rip, 1995:424). Visions may differ significantly between established firms and new firms and the alignment in a network requires special effort. Rip points out the importance of macro-actors, such as large technology introducers, government agencies and other 'general interest' actors, as well as relatively independent, and specially constructed macro-actors like 'platforms' or mixed consortia (Rip, 1995:426).

2.3 Prioritisation of public funding of demonstration programmes for sustainable energy and transport

According to the transition management literature, change arises through the interaction between the following levels of governance activities: strategic, tactical and operational, and reflexive (Kemp et al., 2007:82; Loorbach, 2007:101ff.). Loorbach and Rotmans (2010) explain these levels of governance activities as following:

1. *Strategic level:* processes of vision development, strategic discussions, long-term goal formulation, culture change etc.; this includes governance activities related to long-term changes, which are not institutionalised in regular political cycles and have a time horizon of 30-50 years;
2. *Tactical level:* processes of agenda building, negotiating, networking, coalition building, identification of 'barriers' etc.; this includes steering actions (planning and control, prioritisation of financial support and programmes) and institutions (rules, regulations, organisations, networks, routines, infrastructure) related to the dominant sociotechnical regime and have a time horizon of 5-15 years;
3. *Operational level:* processes of experimenting, project building, implementation of governance, and autonomous actions to achieve individual goals, etc.; this is the level of radical innovation, referring to activities with a time horizon of up to 5 years.

4. *Reflexive:* cross-cutting processes of monitoring, assessment and evaluation of policies and processes, by a wide variety of organisations and citizens, for different purposes.

To analyse policy priorities includes therefore not just the priorities of the demonstration programmes, but also the underlying visions and long-term goals in the respective society, e.g. visions for a fossil free society, and the process of agenda building at the tactical level, e.g. who has been involved in the prioritisation process and what kind of routines and regulations have been found to realise the identified priorities.

Our literature review revealed the following conclusions regarding the governance of demonstration projects and programmes (Klitkou et al., 2013:23f.):

- user involvement is crucial at all stages of demonstration projects to facilitate information and learning,
- project design should not be rigid to allow user input and modifications to improve effectiveness,
- careful planning to take account of market readiness and user participation,
- considering the required size of the projects,
- dissemination of results and evaluation information should be included in the project design,
- projects should ensure in their budgets performance monitoring, maintenance and trouble-shooting, which are all essential for learning,
- the programme should be clear about the maturity of the technology to be demonstrated. Subsidies for demonstration projects and trials of new generations of technology should not be used for the older generation of technology (ibid.).

2.4 Innovation studies

According to Powel and Grodal, there has been a clear transformation in innovation networks over the last decades (2005). Earlier collaboration was a step to enter new markets and was often followed by mergers and vertical integration. Over the last decade, this mode of networking has been replaced by strategic collaboration in various forms of inter-organisational partnerships, especially to promote R&D and the development of new technologies. Innovation and formal networks "constitute a virtuous cycle" (2005:67). Powell and Grodal highlight different benefits of inter-organisational relationships, such as "information diffusion, resource sharing, access to specialised assets, and interorganizational learning" (2005:59). A feature of innovation processes, which is important for demonstration projects, is technological uncertainty. High technological uncertainty is a reason why firms engage in strategic alliances to enhance performance, get access to diverse sources of information and to share the risks (ibid., p. 68). In knowledge-intensive industries, internal R&D capacity and technological sophistication are positively correlated with strategic networking (ibid.). Powell and Grodal point out that it is important to distinguish between different organisational modes of innovation cooperation, since they produce different impact on participating firms' innovation activity. While weak ties in informal-non-contractual innovation cooperation serve more as bridges to novel information where there is a rapid exchange, strong ties can be useful for social control and the exchange of tacit knowledge (Powell and Grodal, 2005:69). Informal, weak ties often lay the ground for strong, contract-related ties.

In-house R&D activities and adequate absorptive capacity and knowledge base are important for firms to efficiently exploit the external sources of knowledge in innovation cooperation (Herstad et al., 2014). The type of knowledge base of a firm (analytical or synthetic) has importance for the probability to engage in collaboration. Firms with a context-specific 'synthetic' knowledge base are less involved in international collaboration and more involved in collaborations in the more immediate geographical surrounding compared to firms with an analytical knowledge base, and they are significantly less likely to enter a global network (ibid.). The work of firms relies on previous rounds of innovation activities and knowledge, technology and routines already accumulated and controlled by the firm. The firms are embedded in existing systems and can be characterised by lock-ins in their trajectories.

The literature of innovation systems has addressed networks as one of the key elements both in national innovation systems (NIS) and in technological innovation systems (TIS). In their theoretical framework for the comparative analysis of NIS in ten small countries Edquist and Hommen point out, that networking is an important activity to provide the constituents of NIS:

> "Networking through markets and other mechanisms, including interactive learning between different organizations (potentially) involved in the innovation processes. This implies integrating new knowledge elements developed in different spheres of the SI and coming from outside with elements already available in the innovating firms" (Edquist and Hommen, 2008a:10).

2.5 Outcomes of demonstration projects

Hellsmark (2011) applies the TIS approach with the focus on different functions of such systems (Bergek et al., 2008a; Bergek et al., 2008b; Hekkert et al., 2007) in his analysis of the role of system builders in realising the potential of second-generation transportation fuels from biomass. He identifies the following roles of demonstration projects related to the different functions of technological innovation systems: (1) they contribute to the formation of knowledge networks, (2) they reduce technical uncertainties, (3) they facilitate learning that can be instrumental for decisions on technology choice, (4) "they may also raise public awareness of the technology, strengthen its legitimacy and expose system weaknesses such as various institutional barriers" (2011:34), and, (5) they may form a starting point for advocacy coalitions. Karlström and Sandén list similar results of demonstration projects: (1) learning which will be fed back into technical development, (2) open up a market by improved public awareness and scrutinizing institutional barriers, and (3) developing a network of actors (2004:288).

Public funding agencies have invested heavily in trial and demonstration projects for sustainable energy solutions over recent years. This makes it crucial to understand why certain projects do or do not succeed. Success can be measured by comparing the objectives of the projects and the achieved outcomes of the project. Intangible learning outcomes are important here (Kamp et al., 2004), and strengthened networking between firms, technology providers, authorities, user groups and other stakeholders (Hoogma et al., 2002).

The measurement of the tangible and intangible outcomes, intended and unintended effects and long-term impacts of trial and demonstration projects can provide important insights for policy makers. Countries have invested heavily in trial and demonstration projects for sustainable energy solutions over recent years. This makes it crucial to understand why certain projects do or do not succeed and how the funding programmes can be improved. Success can be measured by confronting the aims of the projects with its achieved outcomes. Intangible learning outcomes are important (Kamp et al., 2004) and strengthened networking between firms, technology providers, authorities, user groups and other stakeholders (Hoogma et al., 2002).

Harborne, Hendry and Brown (Harborne and Hendry, 2009; Harborne et al., 2007) distinguish between different *results of demonstration projects* supported by the government: "(i) learning, (ii) opening a market through increasing customer awareness and clarifying institutional barriers, and (iii) forming a network of actors to drive technology and policy change" (Harborne et al., 2007:169).

Hendry et al. addressed the issue of ownership of the learning outcomes of the demonstration projects and trials (2010:4516), for instate to what extent the learning has been captured only by a single firm or whether it has been disseminated to others. Different stakeholders have different interests and can act differently in the diffusion of the results of the projects. An issue is also how larger companies and SMEs collaborate in such projects and how the companies retain control of significant intellectual property. Hendry et al. concluded that it may be easier to enable learning "down the supply chain than in promoting technology exchange between partners" (2010:4517).

National funding programmes for demonstration and trial projects for sustainable energy and transport solutions have to balance between two priorities: (1) by addressing so-called Grand Challenges supporting the transition towards more sustainable solutions and (2) by improving funding possibilities for demonstrating and testing new solutions strengthening the competitiveness of national actors. While transition processes require international collaboration, the national policy focus is often excluding international knowledge exchange. Such tensions have to be addressed (Kallerud et al., 2013:18). Another interesting question is if demonstration projects are based on collaboration between the usual suspects, such as firms and R&D organisations, or if they include also other types of societal actors, such as NGOs, local authorities or private foundations.

2.6 Measuring networking

Traditionally, networking of system actors has been captured by either qualitative methods, e.g. case studies, or by two types of quantitative measures: (1) co-authorship of scientific articles (Calvert and Patel, 2003; Katz and Hicks, 1998; Katz and Martin, 1997) and co-inventorship measured by patents (Breschi and Lissoni, 2004; Campos et al., 2007), and (2) answers in the European Community Innovation Surveys or similar innovation surveys about preferred collaboration partners (e.g., Edquist and Hommen, 2008a, b; Laursen and Salter, 2004). The first alternative is biased towards R&D based knowledge networks, and might underestimate collaboration with system actors, which do not contribute to scientific articles. And the use of patents might be biased toward a high-technology industries where patenting is more common (Powell and Grodal, 2005). This can be too narrow because many inventions are never patented. The second alternative is often not specific enough to enable a better understanding of collaboration, and the comparability of the survey results across countries is questionable due to different routines and requirements to answer the survey. Several researchers use specifically designed surveys to measure cooperative agreements and larger partnerships between universities and industry actors as an indicator for research collaboration (Hagedoorn et al., 2000).

2.7 Innovation networks in Scandinavia

How does the innovation literature reflect the existing innovation networks in the Scandinavian countries? Here we mainly use the comparative study of the innovation systems in ten small countries as a point of departure and revisit their assessment of the state of affairs regarding networking in the three countries based on CIS3 data and a general assessment of the countries (Edquist and Hommen, 2008b).

2.7.1 Sweden

According to Bitard et al. the underlying challenge of the Swedish innovation system is the dominance of large incumbent firms and the limited expenditures of small and medium-sized enterprises on innovation (2008). While there is a strong development in the knowledge-intensive business services (KIBS) also regarding networking, the innovativeness of the engineering and manufacturing sector is less developed. Performance was poorer for process innovations than for new (to the firm) product innovations. Bitard et al. highlight also a mismatch between specialisation in R&D and technology "potentially explaining that there is a problem in transferring scientific knowledge into industrial needs in Sweden" (Bitard et al., 2008:245). Based on analysis of CIS data they conclude that the proportion of cooperating enterprises was rather low in compared to other European countries.

2.7.2 Denmark

In Denmark, “the ‘mode of innovation’ [is] dominated by small and medium-sized enterprises (SMEs) continuously making incremental innovations based on learning by doing, learning by using and learning by interacting, especially with customers and suppliers” (Christensen et al., 2008:403). Established trust relations are easing the exchange of information (ibid., p. 404).

Some attempts have been made to use specific survey data for the Danish energy innovation system (Borup et al., 2009; Borup et al., 2008; Borup et al., 2013; Tanner et al., 2009). The most recent report shows that a large share of cooperation relations is interaction in Denmark, while only a smaller share is international collaboration (Borup et al., 2013).

2.7.3 Norway

Collaboration between firms is important for the national innovation system of Norway (Grønning et al., 2008). The most frequent partners are suppliers, followed by customers and research institutes. About a third of the firms had Scandinavian or European partners. Firms that collaborated with US partners were mainly “large firms with activities related to oil and gas, shipping and production of chemicals. Smaller firms within other sectors such as aquaculture and furniture did not report any such collaboration” (ibid.).

The strong position of the research institutes has functioned as a buffer for the system, but has also functioned as a lock-in mechanism which functions as “a disincentive to firms developing competitive in-house or firm-to-firm collaborative R&D activities” (Grønning et al., 2008:310).

2.8 Research questions

We have formulated the following research questions:

1. How successful do Scandinavian demonstration projects contribute to the development of knowledge networks for sustainable energy and transport transitions?
2. Do Scandinavian demonstration programmes prioritise learning in international knowledge networks and user involvement?

3 Data and methods

The InnoDemo applied a mixture of quantitative and qualitative methods:

1. Construction of an inventory of public funded demonstration and trial projects
2. Analysis of the inventory with regard to key indicator such as number of projects, funding over time, technological specialisation, objectives of projects etc.
3. Survey with project managers on the aims and results of demonstration projects
4. Social network analysis (SNA) of collaboration patterns
5. Qualitative methods: interviews with project managers and project participants and focus groups and interviews with programme managers

3.1 Construction of the inventory

We have selected technologies that are promising platforms for a transition to a more sustainable energy system and transport system, such as renewable electricity, hydrogen, and sustainable biofuels. The future development pathways of these technologies are challenged by a high degree of technological, social and economic uncertainty as well as durability of the incumbent fossil-fuel based energy and transport system.

We created a database over demonstration and trial projects funded by public agencies or programmes in Scandinavia over the last decade. The inventory was created in two steps:

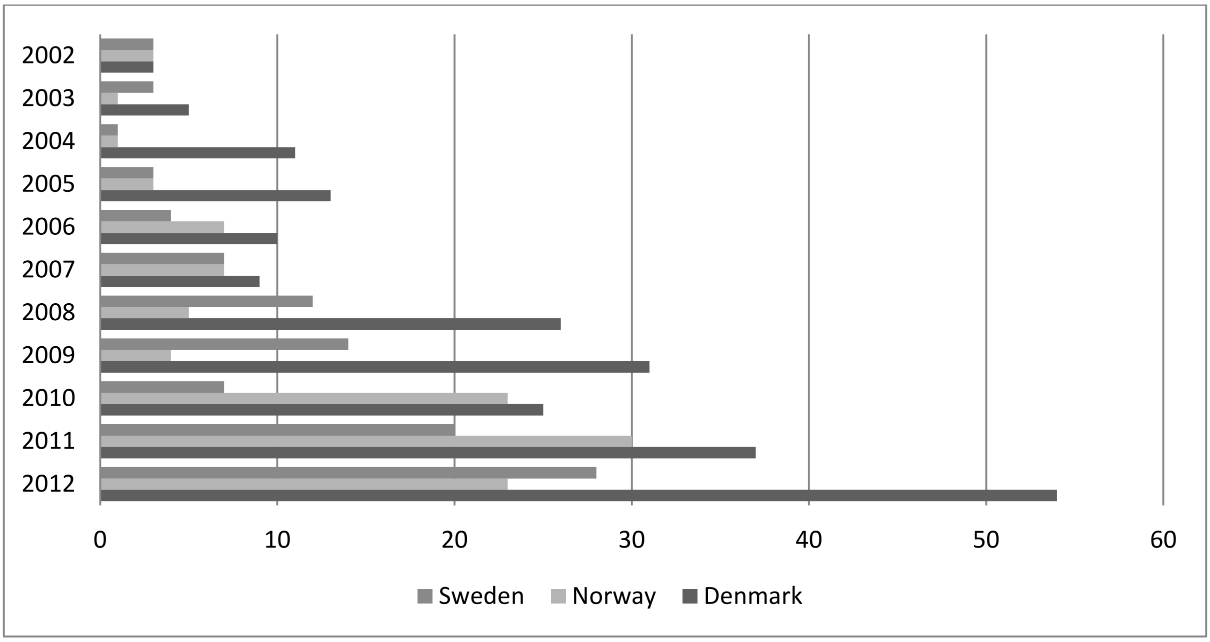
1. Creation of a database template in Access and guidelines for the collection of data, which fulfilled our needs for future analysis;
2. Collection of data from the different programmes in the three countries.

The access to project data varied between the countries. While in Denmark and Sweden such information was publicly accessible, in Norway the different programmes followed different rules. Access to the data for two of the programmes was only given if we secured confidentiality of the information. This means that we have to present the Norwegian data collected in the inventory only in aggregated and anonymised form. This means also that we cannot make the inventory public as originally planned.

3.2 Analysis of the inventory

The database gives an account of the targeted energy and transport technologies, project objectives, project partners, funding programmes, duration and funding. We identified 433 demonstration projects starting in the period 2002–12, in Denmark 224 projects, in Norway 107 projects and in Sweden 102 projects (Dannemand Andersen et al., 2014b). Less than one fourth of the projects targeted road transport solutions, mainly electrical mobility and biofuel/biogas. Figure 1 shows the development of the number of projects funded since 2002. We can see a clear increase at the end of the 00s in all three countries. This can be explained by the introduction of new policy instruments in this period.

Figure 1: Number of projects in the database; distributed over starting years and countries. N=433.



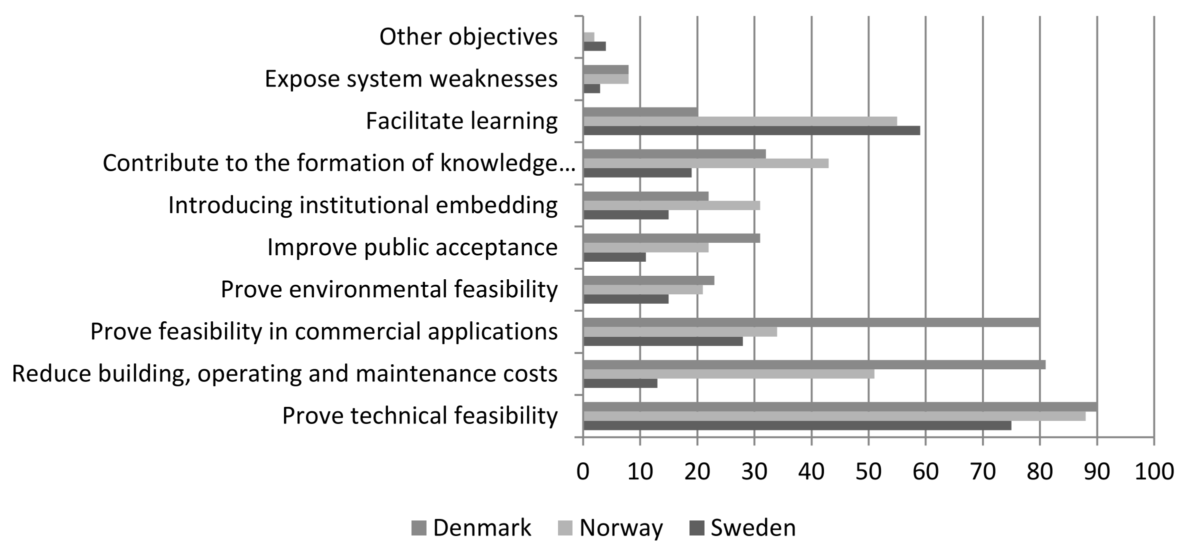
The group around Harborne, Hendry and Brown developed a taxonomy of demonstration and trial projects and programmes according to their aims (Harborne and Hendry, 2009:3588; Hendry et al., 2010), distinguishing between (1) prove technical feasibility, (2) reduce building, materials, components, operating and maintenance costs, (3) prove feasibility in commercial applications, and hybrid projects with a combination of aims. We have developed this taxonomy further (Klitkou et al., 2013) and distinguish between the following aims, acknowledging that projects can have several aims and categorised the identified projects accordingly:

1. prove technical feasibility
2. reduce building, operating and maintenance costs
3. prove feasibility in commercial applications
4. prove environmental feasibility
5. contribute to the formation of knowledge networks
6. improve public acceptance
7. introduce institutional embedding
8. expose system weaknesses
9. facilitate learning

From the analysis of the database we found that proving technical feasibility is the aim in more than half of all projects, while for one third of the projects the following aims were listed: to reduce building, operating and maintenance costs, to prove feasibility in commercial applications, and to facilitate learning. In less than one fourth of the projects to contribute to the formation of knowledge networks was the project aim (Dannemand

Andersen et al., 2014a). The other aims are less prominent. However, the analysis of the project objectives reveals a number of interesting differences regarding priorities between the three countries. Main differences exist for the following aims: facilitate learning, formation of knowledge networks, institutional embedding, public acceptance, commercial feasibility and reduction of costs (Figure 2). In the Danish project facilitating learning was less prioritised than in the two other countries. And in the Swedish projects the formation of knowledge networks, reduction of costs and public acceptance were less prioritised.

Figure 2: Objectives of demonstration projects



Note: Each project can have multiple aims.

A survey was develop to follow-up the analysis of the inventory. The survey was sent to 370 project managers in Norway, Sweden and Denmark. We achieved a low response rate of 22%. For the results of the survey, see the specific report authored by Olsen (2014). In this report, we include not the quantitative results of the survey due to the low response rate, but use interviews with some of the project managers regarding collaboration (chapter 5).

3.3 Social network analysis of collaboration patterns

For answering the *first research question*, a social network analysis (SNA) has been applied to analysis of effects of such projects for networking of the involved actors. The SNA has been conducted for two periods – 2002–2008 and 2009–2012 – to show if there are changes over time. We distinguish between different types of partners, such as private companies, universities, research institutes, non-governmental organisation, municipalities, regional and national administration, public funding agencies and other public agencies. We distinguish between national and international collaboration patterns based on the localisation of the partners.

The SNA identified about 360 nodes in the Danish projects, 340 nodes in the Norwegian projects and 190 nodes in the Swedish projects. Key statistical indicators are given for all three countries:

- Number of projects analysed
- Number of interlinking projects and share of all projects
- Number of projects with foreign partner and share of all projects
- Number of sub-networks
- Number of networked nodes

- Average network density
- Fragmentation of the network
- Size of largest sub-network measured in number of nodes based on x projects and share of all projects and of the whole network.

SNA techniques to measure different types of centrality in the networks have been applied, such as Freeman's Betweenness centrality and Degree Centrality. Betweenness centrality is defined as the number of times a node acts as a bridge along the shortest path between two other nodes (Freeman, 1977). Degree centrality is defined as the number of links that a node has (Borgatti, 2005). The top ten actors in each country based on both centrality measures are given for each country.

The SNA calculations have been done with the SNA software Ucinet developed by Borgatti, Everett and Freeman (2002). The SNA maps have been created with the help of the software NetDraw developed by Borgatti (2002). The SNA maps are based on betweenness centrality measures and spring-embedding tis applied as the graph-theoretical layout.

3.4 Qualitative methods: interviews and focus groups

For answering the *second research question*, we use results of qualitative research methods. Interviews and focus groups with programme coordinators in the three countries and interviews with project managers and participants of selected demonstration projects have been used as empirical background for the project.

We conducted 26 interviews with project managers and project participants about the collaboration in the projects, their expectations and learning processes in the project (see Annex 1: The interview guide for the interviews with the project managers). For the coverage of the interviews in the three countries, see Table 1.

We conducted two focus groups and five individual interviews with programme managers (see for details on the programmes in Table 2) about programme priorities, project collaboration, user involvement, project design and planning, monitoring and evaluation of projects, and maturity of technology (see Annex 2: The interview guide for the focus groups and interviews with the programme managers). For this paper, we used especially the sections on programme priorities, project collaboration and user involvement. The results for the different programmes are summarised in section 6. The prioritisation of collaboration by the programmes funding demonstration projects.

Table 1: Interviews with project managers and other participants, by country.

Country	Project managers	Project participants	Focus groups	Programme managers
Denmark	5	4		4
Norway	6	2	2	
Sweden	6	6		2

Table 2: List of programmes covered by focus groups and interviews with programme managers.

Denmark:	Energy development and demonstration programme, EDDP
	Green Labs DK
	Test scheme for electrical vehicles
Norway:	Enova SF
	Innovation Norway, Environmental Technology Financing Scheme

	Research Council of Norway, ENERGIX
	Transnova
Sweden:	Swedish Energy Agency, Demonstration programme for more efficient biogas production
	Swedish Energy Agency, Demonstration programme for electric vehicles

The limited number of project manager interviews – we covered 17 projects out of 433 projects – does of course not allow quantifying the results. All citations are anonymised. However, the results give nevertheless insights and a deeper understanding of collaborative relations in demonstration projects. They reveal processes, which cannot be captured with indicators, even not with SNA. The results are summarised in chapter 46.

Here we use especially the section about collaboration. At the start of the interview we asked why partners had been included in the project and if the partners fulfil their roles as expected:

- According to our information, the following partners were involved: XXXX Can you explain why each of them were included in the project?
- Did each of the partners fulfil the role in the project as expected, or did some of them take up different roles than what was expected when they were included in the project?
- How will you evaluate the contribution of each of the different partners to the project?

We asked also to highlight the most central partners beside the project manager:

- Were some of the collaboration partners more central to the project than other? Who were the central partners?

We asked how the contact evolved throughout the project:

- How close contact with the partners did you have throughout the project?

We asked the project managers to characterise differences or similarities between the partners with regard to way of thinking, educational background, organisational culture and how this eventually influenced positively or negatively their collaboration:

- Generally speaking, would you say that the collaborators in the project were at the same wavelength – do you think in similar ways?
- Did the people involved in the collaboration generally have similar educational backgrounds, or was it a very diverse group?
- Generally speaking, would you say that the cultures in the partner organisations, in terms of for instance norms, values and routines, were quite similar or quite different?

In our interviews we asked following questions related to weak, more informal ties:

- How was contact to the partners initiated?
- Did you know all of them well prior to project start?
- So would you say that you had trustful relations to your partners when you started the project?
- Did it influence your collaboration positively or negatively that you [knew each other well / didn't know each other] prior to project start?

4 Social network analysis of collaboration in demonstration projects

In this chapter we present the results of the Social network analysis (SNA) for the three countries.

First, we give an overview of all demonstration projects with more than one partner and which started between 2002 and 2012 for the respective countries and identify the main organisations in the countries applying degree centrality and betweenness centrality measures and distinguishing between different types of partners, and identify the sub-networks in the three countries. All the SNA maps include only projects with more than one participant.

Secondly, we analyse the largest sub-network, applying betweenness centrality measures.

Thirdly, we present the results for all sub-networks for two periods: 2002–2008 and 2008–2012 and comment on changes from the first to the second period.

Finally, we summarise the findings in a comparative analysis.

4.1 Sweden

4.1.1 Overview of all networked demonstration projects

The SNA for the Swedish demonstration projects identified 169 nodes based on 38 projects out of 102 projects (37 per cent of all projects) which had more than one participant. The SNA identified 12 sub-networks; four of them included just two partners (Figure 3). Five projects had at least one foreign partner. The overall fragmentation of the Swedish network is 1.2E+0269. This fragmentation can be explained by rather loose connection between Swedish projects. The density of the Swedish network is 0.0155 with a standard deviation of 0.0543.

Key statistics:

- Number of projects analysed: 102
- Number of interlinking projects: 38 (37% of all projects)
- Number of projects with foreign partner: 5 (5% of all projects)
- Number of sub-networks: 12
- Number of networked nodes: 169
- Average network density: 0.0155

- Fragmentation of the network: 1.2E+0269
- Size of largest sub-network: 87 nodes based on 27 projects (26% of all projects, 51% of network)

The main organisations are listed in Table 3. Here we find mainly four types of organisations: universities (Lund tekniska högskola, Kungliga Tekniska Högskolan, Högskolan Dalarna, Uppsala Universitet, Luleå tekniska universitet), research institutes (SP Sveriges Tekniska Forskningsinstitut AB), firms (Vattenfall R&D AB, Volvo Trucks, E.ON Sverige) and municipal organisations (Göteborgs gatu, Malmö Stad, Stockholms Stad, AB Storstockholms Lokaltrafik). In addition, other organisations can be highlighted (Test Site Sweden, Energitekniskt Centrum i Piteå).

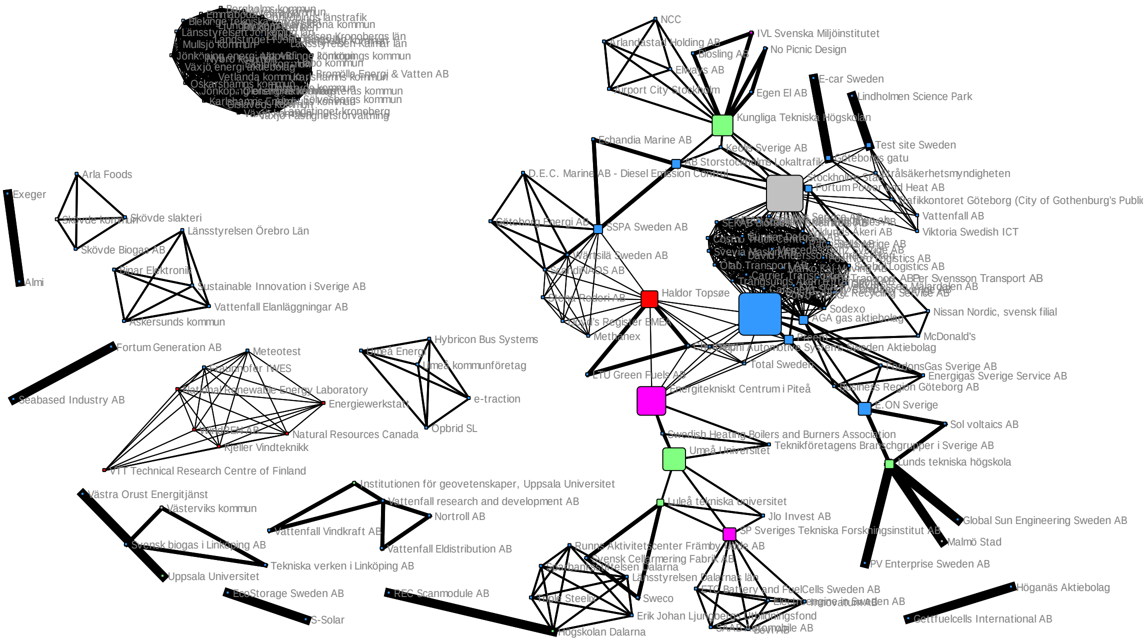
One foreign firm, Haldor Topsøe from Denmark, is important as well. Five projects (5 per cent of all 102 projects) involved foreign partners. Haldor Topsøe was involved in three of them. Kjeller Vindteknikk from Norway participated in one project.

Table 3: The 10 main organisations in the Swedish projects measured by Degree centrality and Betweenness centrality

Freeman's Degree Centrality		Freeman's Betweenness Centrality	
Lunds tekniska högskola	1,833	Volvo Trucks	1 476,000
Kungliga Tekniska Högskolan	1,067	Stockholms Stad	1 220,000
Uppsala Universitet	0,833	Energitekniskt Centrum i Piteå	949,000
SSPA Sweden AB	0,676	Umeå Universitet	760,000
Vattenfall R&D AB	0,667	Kungliga Tekniska Högskolan	644,000
Högskolan Dalarna	0,667	Haldor Topsøe, Denmark	512,667
Göteborgs gatu	0,643	E.ON Sverige	405,000
Test Site Sweden	0,643	SP Sveriges Tekniska Forskningsinstitut AB	405,000
Haldor Topsøe, Denmark	0,619	Lunds tekniska högskola	252,000
Luleå tekniska universitet	0,583	AB Storstockholms Lokaltrafik	221,333

Note: All calculations created with Borgatti, S.P., Everett, M.G. and Freeman, L.C. 2002. Ucinet for Windows: Software for Social Network Analysis. Harvard, MA: Analytic Technologies.

Figure 3: Network of all Swedish demonstration projects identified with more than one participant (N=38 out of 102), started between 2002 and 2012, based on betweenness centrality measures. Number of sub-networks: 12

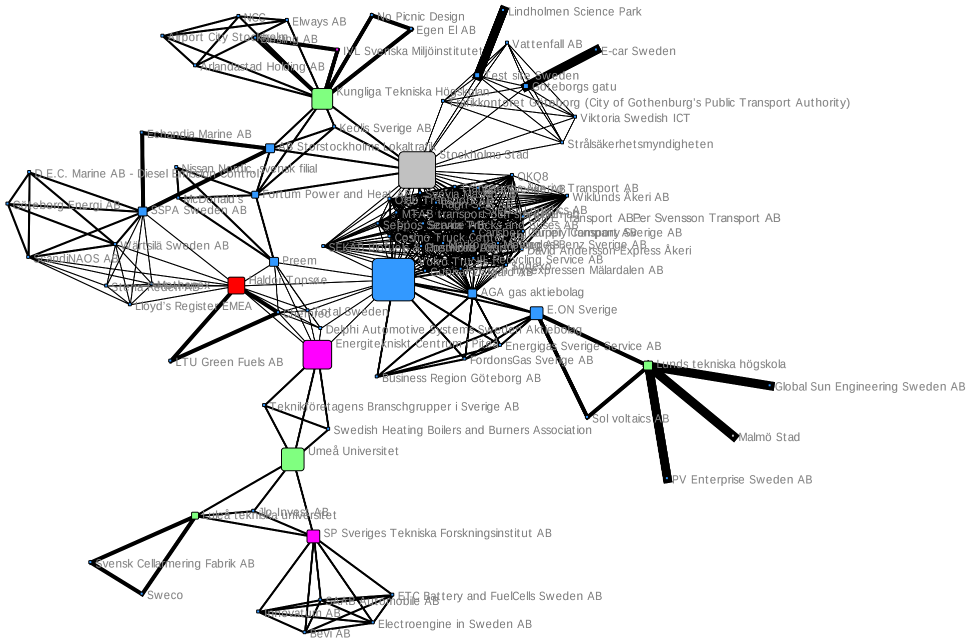


Notes: Included are only projects with more than one participant.
Note: All graphs created with Borgatti, S.P., Everett, M.G. and Freeman, L.C. 2002. Ucinet for Windows: Software for Social Network Analysis. Harvard, MA: Analytic Technologies, and Borgatti, S.P. 2002. NetDraw: Graph Visualization Software. Harvard: Analytic Technologies.

4.1.2 The largest Swedish sub-network

The largest sub-network in the Swedish network is based on 27 projects and includes 87 nodes (Figure 4). The most central position measured in betweenness centrality was held by Volvo Trucks, followed by Stockholms Stad, Energitekniskt Centrum i Piteå, Umeå Universitet and Kungliga Tekniska Högskolan (compare also Table 3).

Figure 4: Network of the largest network of Swedish demonstration projects identified with more than one participant (N=27), started between 2002 and 2012, based on betweenness centrality measures.



4.1.3 Development of the Swedish network from period 2002–08 to period 2009–12

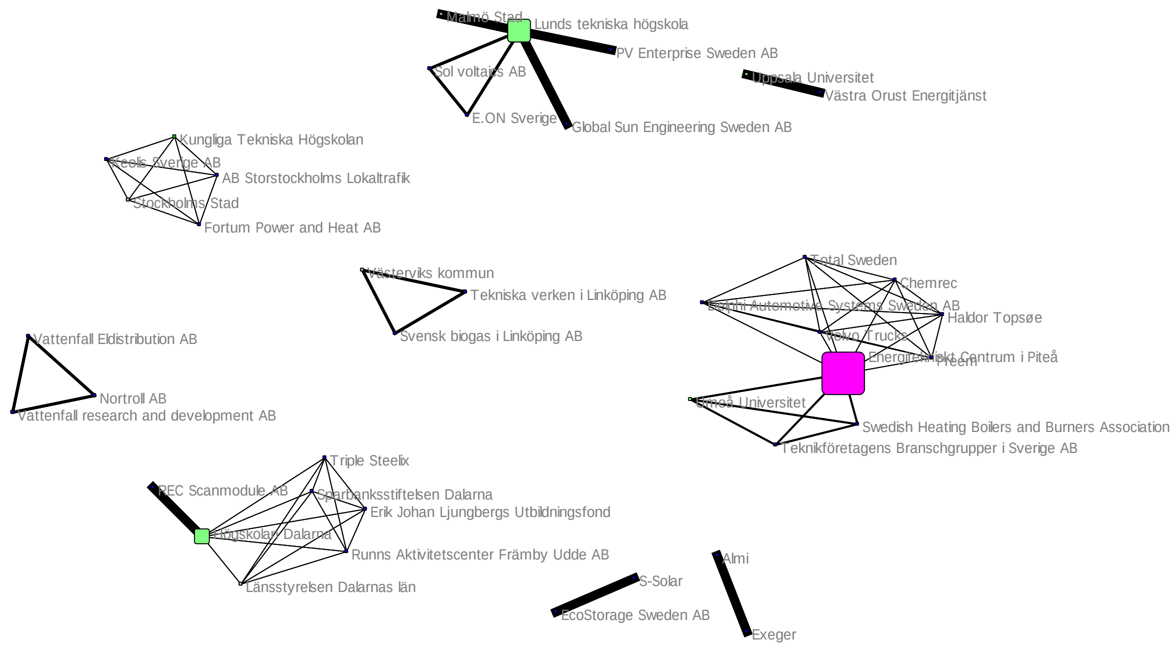
4.1.3.1 2002–2008

The SNA for the Swedish demonstration projects started latest in 2008 identified 40 nodes based on 14 projects out of 33 projects (42 per cent of all projects) and which had more than one participant. The SNA identified nine sub-networks; three of them included just two partners (Figure 5). The density of the early Swedish network is 0.0090 with a standard deviation of 0.0510.

Key statistics:

- Number of projects analysed: 33
- Number of interlinking projects: 14 (42% of all projects)
- Number of projects with foreign partner: 1 (3% of all projects)
- Number of sub-networks: 9
- Number of networked nodes: 40
- Number of project connections: 176
- Average network density: 0.0090

Figure 5: Network of all Swedish demonstration projects identified with more than one participant (N=14), started between 2002 and 2008, based on betweenness centrality measures. Number of sub-networks: 9



4.1.3.2 2009–2012

The SNA for the Swedish demonstration projects started since 2009 identified 141 nodes based on 14 projects out of 33 projects (42 per cent of all projects) which had more than one participant. The SNA identified nine sub-networks; three of them included just two partners (Figure 5). The density of the late Swedish network is 0.0012 with a standard deviation of 0.0134.

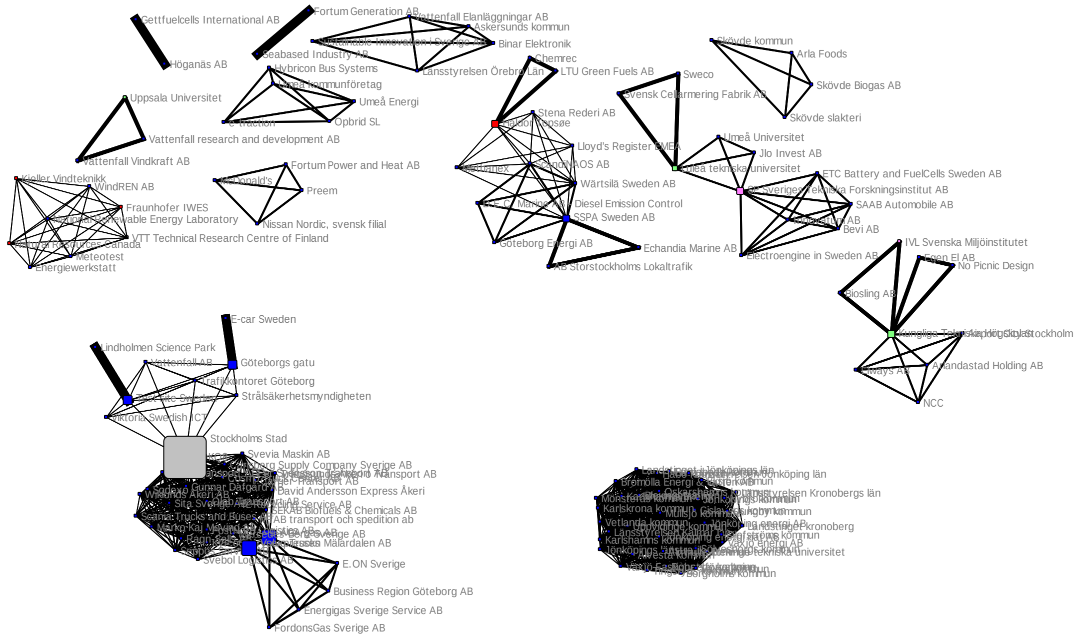
The number of sub-networks has increased in the second period from 9 to 13 sub-networks. And the average density has decreased from 0.0090 to 0.0012. Both indicators can be interpreted as persisting fragmentation tendencies. An explanation for this fragmentation can be the different technological specialisation of the different actors. Another explanation is to be found in the project aims, only 12 projects aimed to contribute to the formation of knowledge networks in the whole period, mostly projects in the second period.

Interesting is the role of some actors which function as bridge builders between different sub-networks, such as SP Sveriges Tekniske Forskningsinstitut AB, Kungliga Tekniske Högskolan and Stockholm Stad.

Key statistics:

- Number of projects analysed: 69
- Number of interlinking projects: 24 (35% of all projects)
- Number of projects with foreign partner: 4 (6% of all projects)
- Number of sub-networks: 13
- Number of networked nodes: 141
- Number of project connections: 2 455
- Average network density: 0.0012

Figure 6: Network of all Swedish demonstration projects identified with more than one participant (N=24), started between 2009 and 2012, based on betweenness centrality measures. Number of sub-networks: 13



4.2 Denmark

4.2.1 Overview of all networked demonstration projects

The SNA for the Danish demonstration projects identified 354 nodes based on 186 projects out of 224 projects (83 per cent of all projects) which had more than one participant. The SNA identified 9 sub-networks; two of them included just two partners (Figure 7). 37 projects had at least one foreign partner. The overall fragmentation of the Danish network is 6.5E+0264. This fragmentation can be explained by rather tight connection between Danish projects. The density of the Danish network is 0.0687 with a standard deviation of 0.1335.

Key statistics:

- Number of projects analysed: 224
- Number of interlinking projects: 186 (83% of all projects)
- Number of projects with foreign partner: 34 (15% of all projects)
- Number of sub-networks: 9
- Number of networked nodes: 354
- Average network density: 0.0687
- Fragmentation of the network: 1.2E+0269
- Size of largest sub-network: 328 nodes based on 177 projects (79% of all projects, 93% of network)

The main organisations are listed in Table 4. Here we find mainly two types of organisations: universities (Danmarks Tekniske Universitet, Aalborg Universitet, Aarhus Universitet, Københavns Universitet) and firms (DONG Energy, Haldor Topsøe A/S, Dantherm Power A/S, IRD A/S, H2 Logic A/S, Danfoss A/S, PlanEnergi A.M.B.A.). In addition should be highlighted a research institute (Teknologisk Institut) and a municipal organisation (Københavns Kommune).

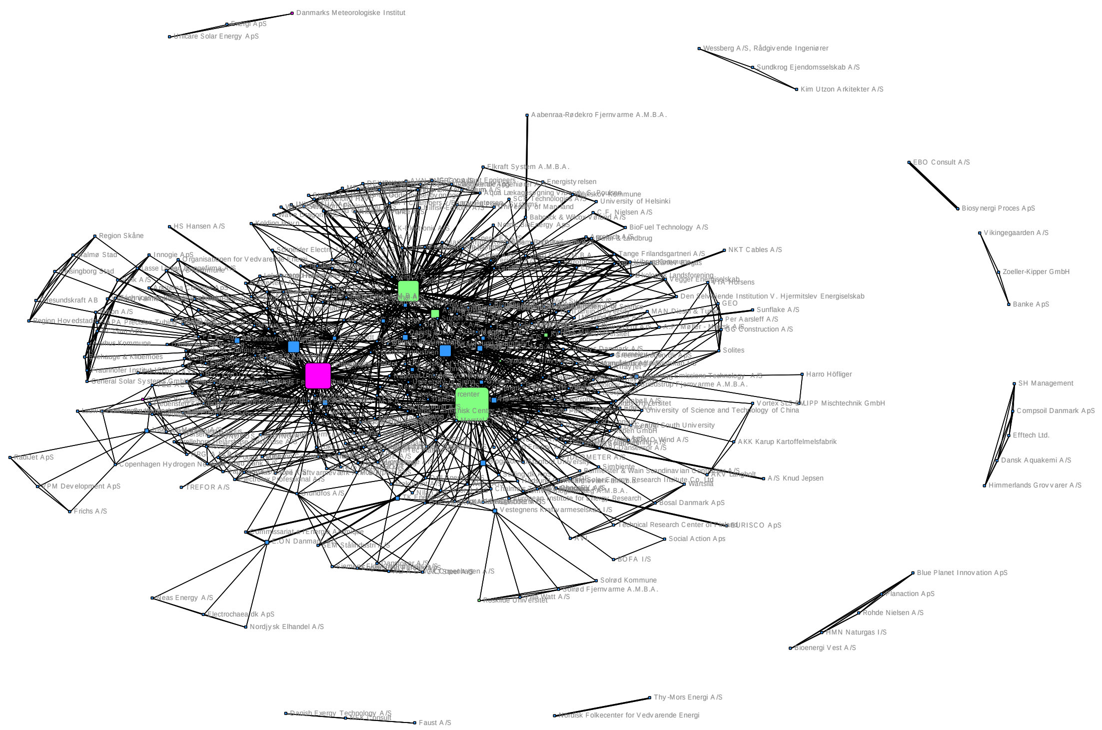
34 projects (15 per cent of all 224 projects) involved foreign partners. 16 German partners were involved in these projects, followed by 7 Swedish partners and 6 U.S. partners. No Norwegian partners were involved.

Table 4: The 10 main organisations in the Danish projects measured by Degree centrality and Betweenness centrality

Freeman's Degree Centrality		Freeman's Betweenness Centrality	
Danmarks Tekniske Universitet	18,861	Danmarks Tekniske Universitet	19 683,572
Aalborg Universitet	10,103	Teknologisk Institut	14 471,109
DONG Energy	8,126	Aalborg Universitet	11 802,664
Teknologisk Institut	7,005	Danfoss A/S	5 573,197
Haldor Topsøe A/S	5,133	DONG Energy	5 416,178
Dantherm Power A/S	3,366	Aarhus Universitet	4 008,290
Aarhus Universitet	3,262	PlanEnergi A.M.B.A.	2 326,469
IRD A/S	3,158	Haldor Topsøe A/S	2 000,342
Københavns Universitet	2,750	IRD A/S	1 823,423
H2 Logic A/S	2,250	Københavns Kommune	1 684,182

Note: created with Borgatti, S.P., Everett, M.G. and Freeman, L.C. 2002. Ucinet for Windows: Software for Social Network Analysis. Harvard, MA: Analytic Technologies.

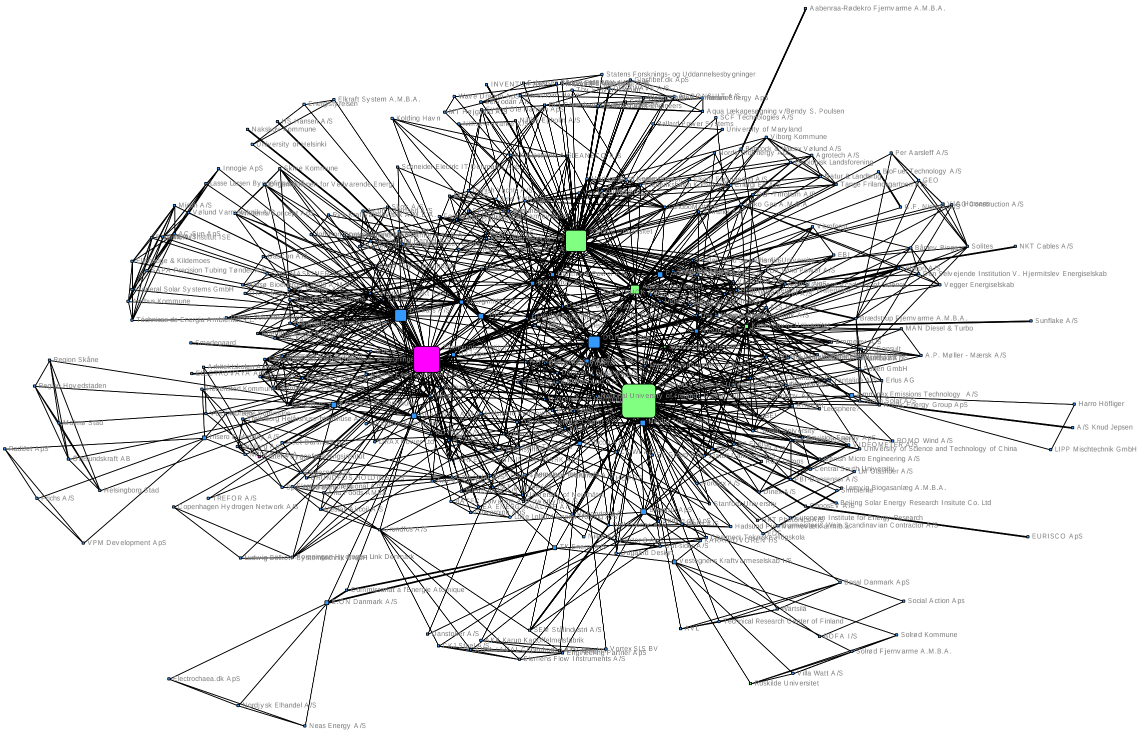
Figure 7: Network of all Danish demonstration projects identified with more than one participant (N=186 out of 224), started between 2002 and 2012, based on betweenness centrality measures. Number of sub-networks: 9



4.2.2 The largest Danish sub-network

The largest sub-network in the Swedish network is based on 177 projects and includes 328 nodes (Figure 8). The most central position measured in betweenness centrality was held by Danmarks Tekniske Universitet, followed by Teknologisk Institut, Aalborg Universitet, Danfoss A/S and Aarhus Universitet (compare also Table 4).

Figure 8: Network of the largest network of Danish demonstration projects identified with more than one participant (N=177), started between 2002 and 2012, based on betweenness centrality measures.



4.2.3 *Development of the Danish network from period 2002–08 to period 2009–12*

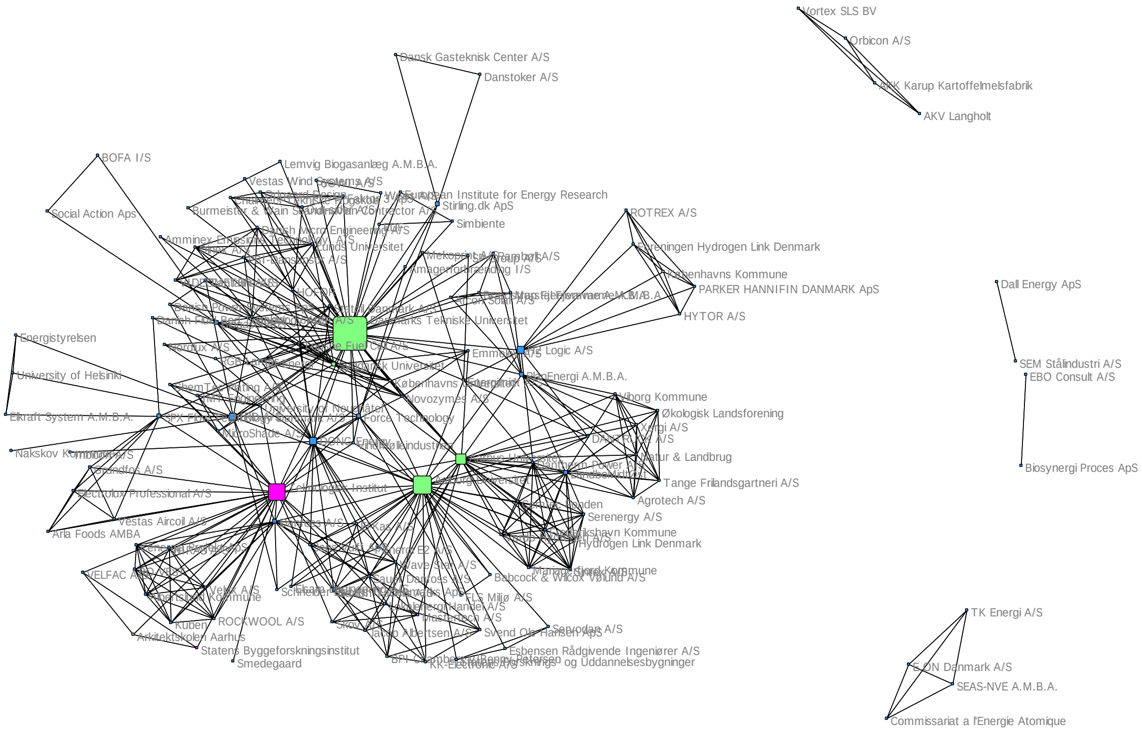
4.2.3.1 2002–2008

The SNA for the Danish demonstration projects started latest in 2008 identified 135 nodes based on 56 projects out of 77 projects (73 per cent of all projects) and which had more than one participant. The SNA identified five sub-networks; two of them included just two partners (Figure 9). The density of the early Danish network is 0.0619 with a standard deviation of 0.1137. 12 per cent of all project included an international partner.

Key statistics:

- Number of projects analysed: 77
- Number of interlinking projects: 56 (73% of all projects)
- Number of projects with foreign partner: 9 (12% of all projects)
- Number of sub-networks: 5
- Number of networked nodes: 135
- Number of project connections: 1 039
- Average network density: 0. 0619

Figure 9: Network of all Danish demonstration projects identified with more than one participant (N=56), started between 2002 and 2008, based on betweenness centrality measures. Number of sub-networks: 5



4.2.3.2 2009–2012

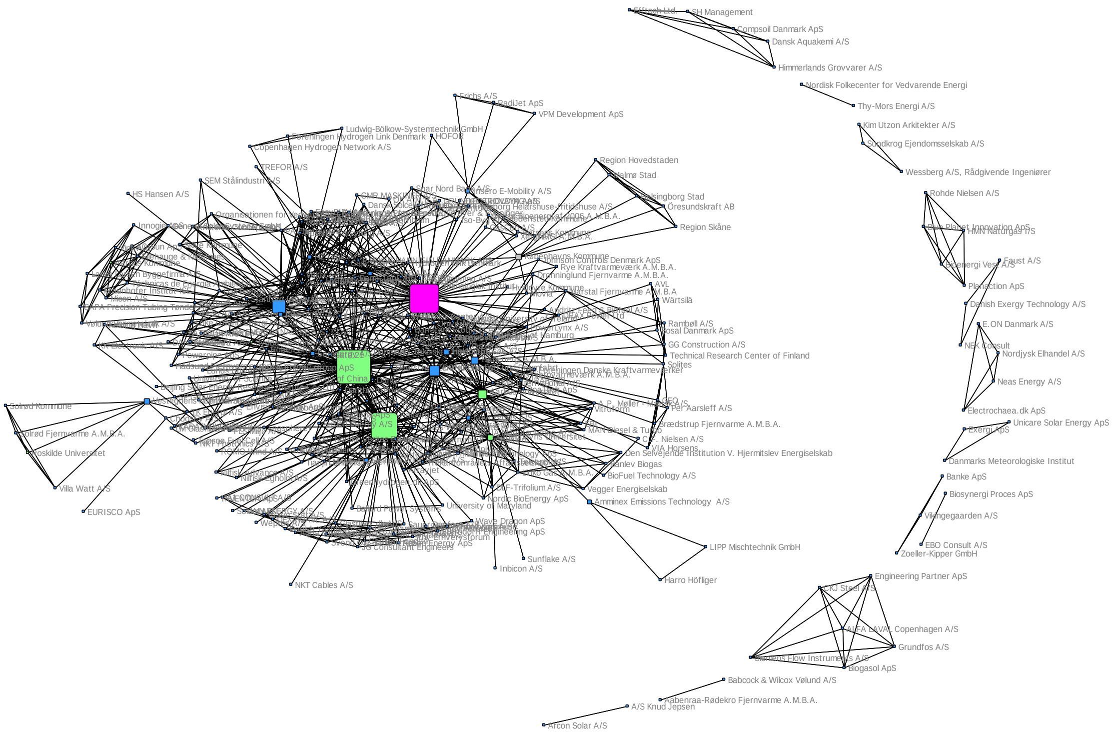
The SNA for the Danish demonstration projects started since 2009 identified 286 nodes based on 129 projects out of 146 projects (88 per cent of all projects) which had more than one participant. The SNA identified 13 sub-networks; four of them included just two partners (Figure 10). The density of the late Danish network is 0.0657 with a standard deviation of 0.1096. 16 per cent of all project included an international partner.

The number of sub-networks has increased in the second period from 5 to 13 sub-networks. And the average density has decreased from 0.0619 to 0.0657. The density indicator can be interpreted as a high degree of networking, while the higher number of sub-networks can be explained with the entrance of new actors, but less as a sign for fragmentation. The size of the largest network in the second period – 246 out of 286 nodes – is a valid argument for a high degree of networking. Another explanation is to be found in the project aims, 34 projects aimed to contribute to the formation of knowledge networks in the whole period, two third of the projects in the second period.

Key statistics:

- Number of projects analysed: 146
- Number of interlinking projects: 129 (88% of all projects)
- Number of projects with foreign partner: 24 (16% of all projects)
- Number of sub-networks: 13
- Number of networked nodes: 286
- Number of project connections: 2 250
- Average network density: 0.0657

Figure 10: Network of all Danish demonstration projects identified with more than one participant (N=129), started between 2009 and 2012, based on betweenness centrality measures. Number of sub-networks: 13



4.3 Norway

4.3.1 Overview of all networked demonstration projects

The SNA for the Norwegian demonstration projects identified 296 nodes based on 86 projects out of 107 projects (80 per cent of all projects) which had more than one participant. The SNA identified 24 sub-networks; seven of them included just two partners (Figure 11). 24 projects had at least one foreign partner. The overall fragmentation of the Norwegian network is 1.2E+0269. This fragmentation can be explained by the high number of small sub-networks. The density of the Norwegian network is 0.0401 with a standard deviation of 0.0710.

Key statistics:

- Number of projects analysed: 107
- Number of interlinking projects: 86 (80% of all projects)
- Number of projects with foreign partner: 24 (22% of all projects)
- Number of sub-networks: 24
- Number of networked nodes: 296
- Average network density: 0.0401
- Fragmentation of the network: 1.2E+0269
- Size of largest sub-network: 237 nodes based on 69 projects (57% of all projects, 70% of network)

The centrality measures for the main organisations are listed in Table 6 but the names are anonymised. Alphanumerical codes have been used to comply with the Norwegian confidentiality rules. The codes of the organisation names are based on a combination of short codes for organisation categories and an ID number. New entrants are defined as starting not earlier than 2002. SMEs are defined as companies with less than 250 employees. The distribution of organisation categories can be seen in Table 5. The most prominent types of organisations are Norwegian SMEs, both incumbent (104) and new entrants (73), followed by Norwegian incumbent large firms (23), foreign incumbent large firms (19) and Norwegian research institutes (15)Here we find mainly the following types of organisations: large incumbent companies (NoI_LC_21, NoI_LC_16), new entrants (NoNE_SME_26, NoNE_SME_72, NoNE_SME_48, NoNE_SME_57), a university (No_Uni_1), two research institutes (NoRD_Inst_7, NoRD_Inst_18), a large municipality (No_Munic_10) and a non-governmental organisation (No_NGO_6).

Table 5: Distribution of types of organisations

Type of organisation	Short code	Number of organisations
Foreign incumbent large firm	FoI_LC	19
Foreign incumbent SME	FoI_SME	7
Foreign municipal company	Fo_MunicComp	5
Foreign new entrant, large firm	Fo_NE_LC	3
Foreign new entrant, SME	Fo_NE_SME	5
Foreign RTO	Fo_RTO	6
Foreign University	Fo_Uni	8
International programme	Int_Program	1
International regional organisation	Int_Region	4
Norwegian governmental unit	No_Gov	1
Norwegian incumbent large firm	NoI_LC	23
Norwegian incumbent SME	NoI_SME	104
Norwegian Municipal company	No_MunicComp	3
Norwegian municipal network	No_Munic_Netw	2

Norwegian municipality	No_Munic	9
Norwegian new entrant SME	NoNE_SME	73
Norwegian new entrant, large firm	NoNE_LC	6
Norwegian NGO	No_NGO	3
Norwegian R&D institute	NoRD_Inst	15
Norwegian Region	No_Region	6
Norwegian University	No_Uni	5
Norwegian University college	No_UniColl	1

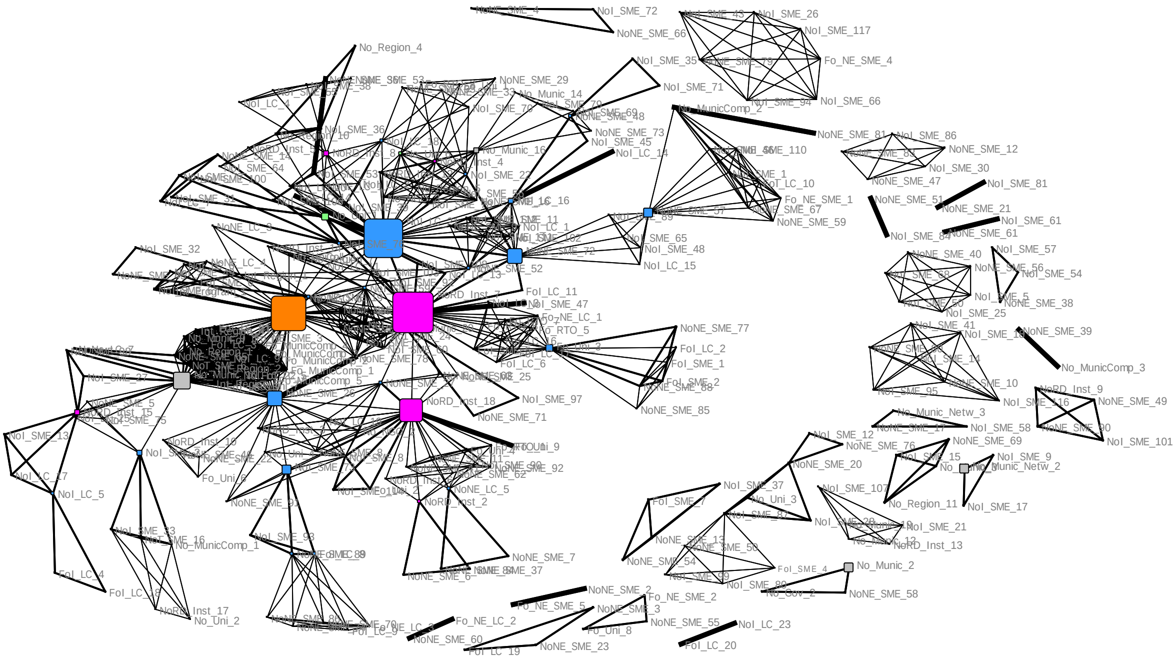
Compared to both Sweden and Denmark there is a high degree of collaboration with foreign organisations: almost every fourth project (22 per cent) includes at least one foreign partner. Partners from 18 countries participate in the Norwegian projects. The most important partnering countries are Sweden (6 projects), Denmark, Germany and the United Kingdom (each five projects).

Table 6: The 10 main organisations in the Norwegian projects measured by Degree centrality and Betweenness centrality

Freeman's Degree Centrality		Freeman's Betweenness Centrality	
NoRD_Inst_7	2.005	NoRD_Inst_7	8522.566
NoI_LC_21	1.902	NoI_LC_21	8221.103
NoRD_Inst_18	1.585	No_NGO_6	7247.182
No_NGO_6	1.069	NoRD_Inst_18	4546.615
NoNE_SME_26	1.032	No_Munic_10	3319.000
No_Uni_1	0.950	NoNE_SME_72	3092.056
NoI_LC_16	0.933	NoNE_SME_26	3085.621
NoNE_SME_72	0.933	NoNE_SME_57	1791.000
NoI_SME_53	0.833	NoI_SME_73	1600.000
NoNE_SME_48	0.667	No_Uni_1	1463.067

Note: created with Borgatti, S.P., Everett, M.G. and Freeman, L.C. 2002. Ucinet for Windows: Software for Social Network Analysis. Harvard, MA: Analytic Technologies.

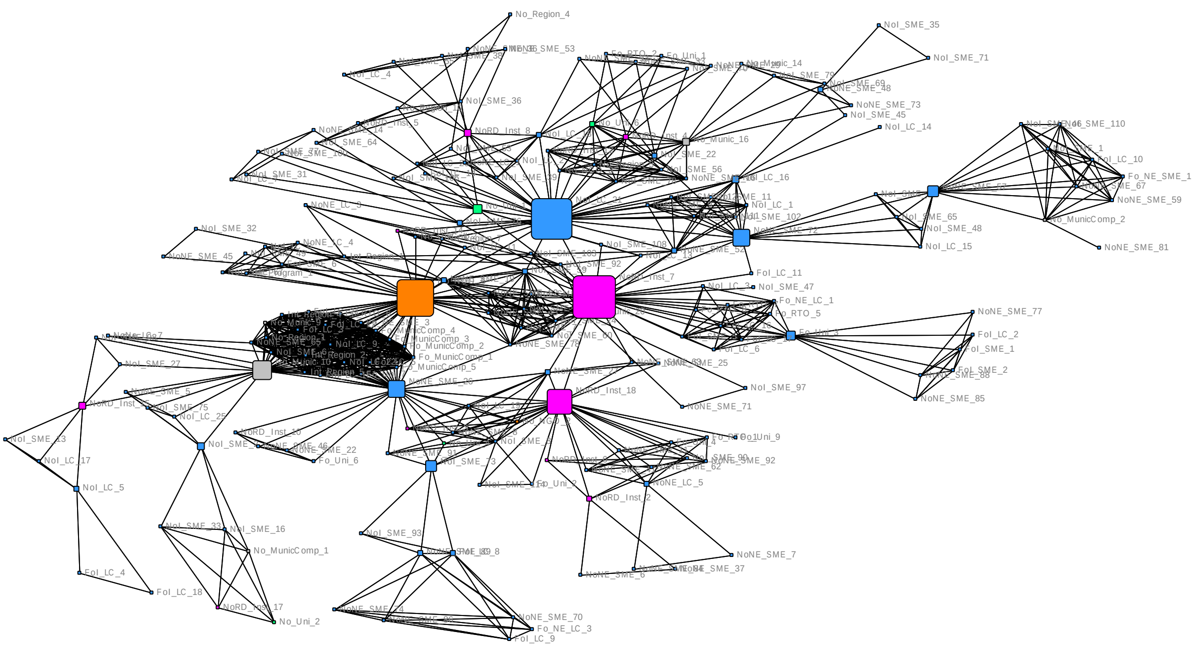
Figure 11: Network of all Norwegian demonstration projects identified with more than one participant (N=86 out of 107), started between 2002 and 2012, based on betweenness centrality measures. Number of sub-networks: 24



4.3.2 The largest Norwegian sub-network

The largest sub-network in the Norwegian network is based on 63 projects and includes 209 nodes. The central position measured in betweenness centrality have a large incumbent company, a research institute, a NGO and a large municipality (compare also Table 6).

Figure 12: Network of the largest network of Norwegian demonstration projects identified with more than one participant (N=69), started between 2002 and 2012, based on betweenness centrality measures.



4.3.3 Development of the Norwegian network from period 2002–08 to period 2009–12

4.3.3.1 2002–2008

The SNA for the Norwegian demonstration projects started latest in 2008 identified 92 networked nodes based on 25 projects out of 27 projects (93 per cent of all projects) and which had more than one participant. The SNA identified 9 sub-networks; three of them included just two partners. Most central in terms of degree centrality and betweenness centrality were in this period a large Norwegian incumbent (NoI_LC_21, NoI_LC_16), a Norwegian university (No_Uni_1), a number of Norwegian SMES, both incumbents (NoI_SME_47) and new entrants (NoNE_SME_48, NoNE_SME_72, NoNE_SME_57) and a Norwegian research institute (NoRD_Inst_7) (see Figure 13).

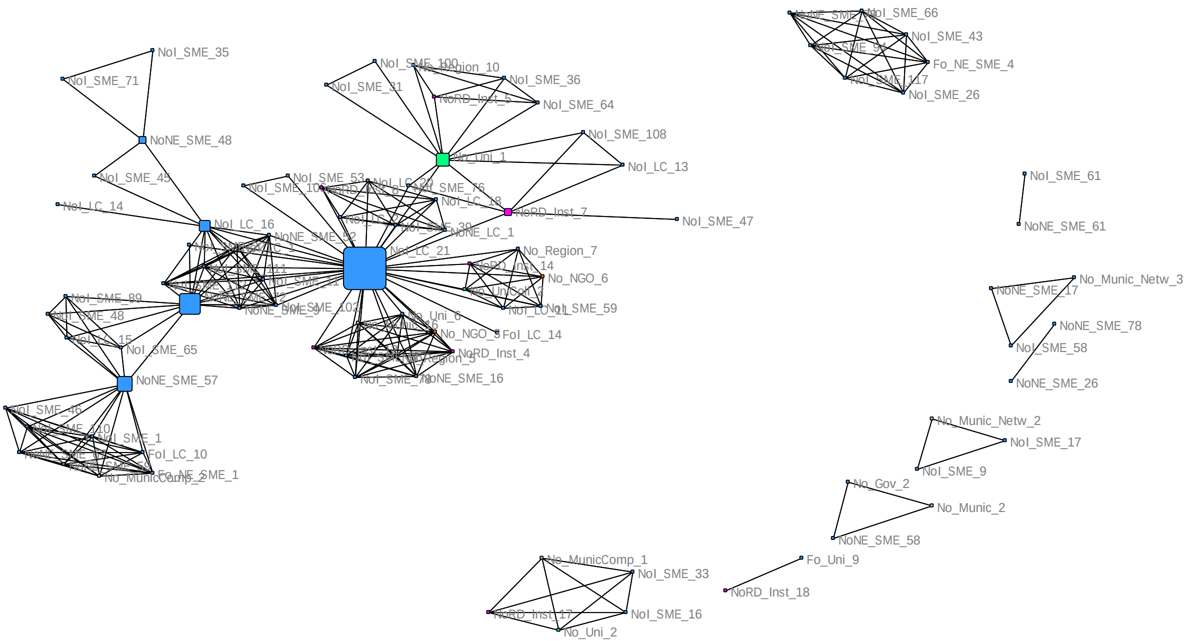
The density of the early Norwegian network is 0.0470 with a standard deviation of 0.0822. Despite the low number of projects with foreign partners is a foreign university (Fo_Uni_9) and a foreign new entrant SME (Fo_NE_SME_4) among the most central nodes.

Key statistics:

- Number of projects analysed: 27
- Number of interlinking projects: 25 (93% of all projects)
- Number of projects with foreign partner: 3 (11% of all projects)
- Number of sub-networks: 9
- Number of networked nodes: 92
- Number of project connections: 532
- Average network density: 0.0473

Most central in terms of degree centrality and betweenness centrality were in this period a large Norwegian incumbent (NoI_LC_21, NoI_LC_16), a Norwegian university (No_Uni_1), a number of Norwegian SMES, both incumbents (NoI_SME_47) and new entrants (NoNE_SME_48, NoNE_SME_72, NoNE_SME_57) and a Norwegian research institute (NoRD_Inst_7).

Figure 13: Network of all Norwegian demonstration projects identified with more than one participant (N=25), started between 2002 and 2008, based on betweenness centrality measures. Number of sub-networks: 9



4.3.3.2 2009–2012

The SNA for the Norwegian demonstration projects started since 2009 identified 226 nodes based on 61 projects out of 80 projects (76 per cent of all projects) and which had more than one participant. The SNA identified 26 sub-networks; seven of them included just two partners (Figure 14). The density of the late Norwegian network is 0.0375 with a standard deviation of 0.0661.

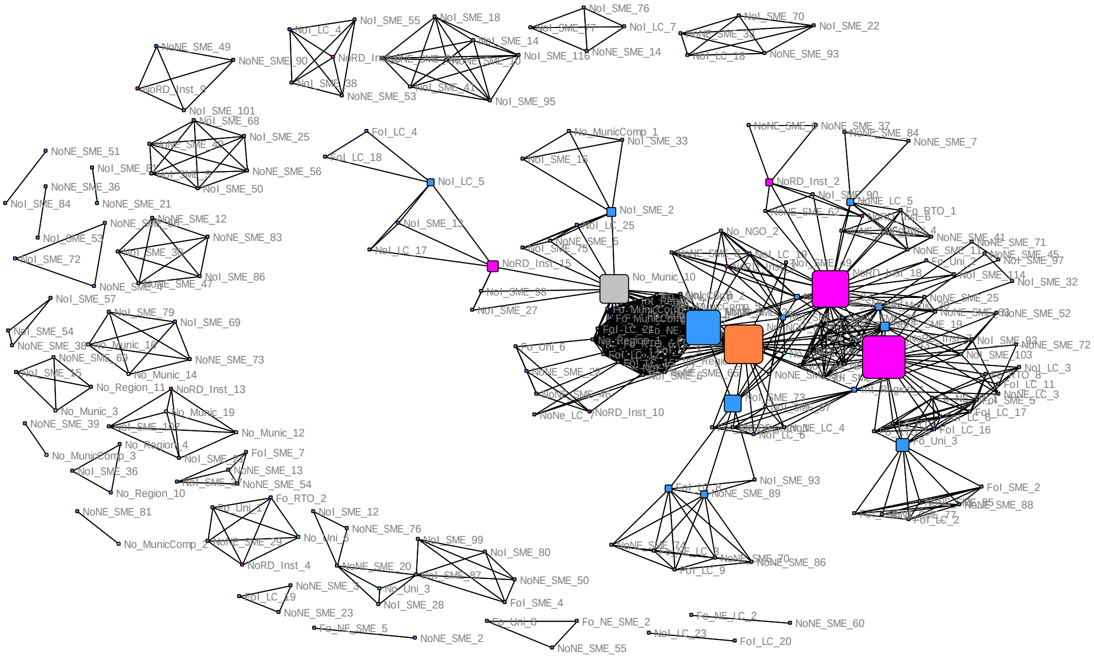
The number of sub-networks has increased in the second period from 9 to 28 sub-networks. And the average density has decreased from 0.0473 to 0.0375. Both indicators can be interpreted as fragmentation tendencies. An explanation for this fragmentation can be the different technological specialisation of the different actors. Another explanation can be the introduction of a new support scheme for demonstration projects that has funded other types of projects than the schemes in the earlier period. When analysing the project aims, 44 projects (45 per cent of all networked projects) aimed to contribute to the formation of knowledge networks in the whole period, 34 of those projects started in the second period.

Interesting is that in the second period the main node in the network is not any longer the large incumbent company (NoI_LC_21), but two Norwegian research institutes (NoRD_Inst_7, NoRD_Inst_18), a Norwegian NGO (No_NGO_6) and a Norwegian municipality (No_Munic_10) have taken over the central position. Important is also the increasing share of foreign partners: from 11 per cent in the first period to 34 per cent in the second period. Again, a foreign university (Fo_Uni_3) is among the ten main nodes, while other foreign actors are less prominent.

Key statistics:

- Number of projects analysed: 80
- Number of interlinking projects: 61 (76% of all projects)
- Number of projects with foreign partner: 21 (34% of all projects)
- Number of sub-networks: 28
- Number of networked nodes: 226
- Number of project connections: 1 689
- Average network density: 0.0375

Figure 14: Network of all Norwegian demonstration projects identified with more than one participant (N=61), started between 2009 and 2012, based on betweenness centrality measures. Number of sub-networks: 28



4.4 Comparative analysis

We identified 354 networked nodes in the Danish projects, 296 nodes in the Norwegian projects and 169 nodes in the Swedish projects. We give a comparative overview of the collaboration patterns of all demonstration projects with at least two partners and which started between 2002 and 2012 for the three countries. The comparative analysis of the network patterns (Table 7) reveals clear differences between the three countries:

- In Denmark existed more than double as many projects in this period compared to Norway and Sweden.
- The numbers of actors differ especially between Denmark and Sweden.
- The share of projects, based on collaboration between at least two partners, is much lower in Sweden compared to Denmark and Norway.
- The network density is highest in Denmark and lowest in Sweden.
- The size of the largest sub-network includes most actors in Denmark (93%) compared to 51% in Sweden.
- Norway has a much higher number of sub-networks than Denmark and Sweden, which can be an indicator for fragmentation.
- The share of projects with international partners is much lower in Sweden compared to Denmark and Norway.

Table 7: Comparative analysis of SNA results for demonstration projects funded in Denmark, Norway and Sweden between 2002 and 2012 (N=433)

	Denmark	Norway	Sweden
Number of projects analysed	224	107	102
Number of interlinking projects	186 (83% of all projects)	86 (80% of all projects)	38 (37% of all projects)

Number of projects with foreign partner	34 (15% of all projects)	24 (22% of all projects)	5 (5% of all projects)
Number of sub-networks	9	24	12
Number of networked nodes	354	296	169
Average network density	0.0687	0.0401	0.0155
Size of largest sub-network	328 nodes (93% of network)	237 nodes (70% of network)	87 nodes (51% of network)

International collaboration relations show an unbalanced pattern. Compared to both Sweden and Denmark Norway has a higher degree of collaboration with foreign organisations: almost every fourth project (22 per cent) includes at least one foreign partner, while the Swedish projects fund much less projects with international participation. Partners from 18 countries participate in the Norwegian projects. The most important partnering countries are Sweden (six projects), Denmark, Germany and the United Kingdom (each five projects). Denmark had no project with Norwegian participation, but strong collaboration with Germany and Sweden, and Sweden had one project with a Norwegian partner and three with a Danish partner.

We identify the main organisations in the three countries applying degree centrality and betweenness centrality measures and distinguishing between different types of partners (the names of the Norwegian organisations are anonymised).

Table 8: The main organisations in the three countries based on measurements for Freeman's Betweenness Centrality.

Denmark		Norway		Sweden	
Danmarks Tekniske Universitet	19 683,572	NoRD_Inst_7	8522.566	Volvo Trucks	1 476,000
Teknologisk Institut	14 471,109	NoI_LC_21	8221.103	Stockholms Stad	1 220,000
Aalborg Universitet	11 802,664	No_NGO_6	7247.182	Energitekniskt Centrum i Piteå	949,000
Danfoss A/S	5 573,197	NoRD_Inst_18	4546.615	Umeå Universitet	760,000
DONG Energy	5 416,178	No_Munic_10	3319.000	Kungliga Tekniska Högskolan	644,000
Aarhus Universitet	4 008,290	NoNE_SME_72	3092.056	Haldor Topsøe, Denmark	512,667
PlanEnergi A.M.B.A.	2 326,469	NoNE_SME_26	3085.621	E.ON Sverige	405,000
Haldor Topsøe A/S	2 000,342	NoNE_SME_57	1791.000	SP Sveriges Tekniska Forskningsinstitut AB	405,000
IRD A/S	1 823,423	NoI_SME_73	1600.000	Lunds tekniska högskola	252,000
Københavns Kommune	1 684,182	No_Uni_1	1463.067	AB Storstockholms Lokaltrafik	221,333

In *Denmark,* mainly two types of organisations are active: universities (Danmarks Tekniske Universitet, Aalborg Universitet, Aarhus Universitet, Københavns Universitet) and firms (DONG Energy, Haldor Topsøe A/S, Dantherm Power A/S, IRD A/S, H2 Logic A/S). In addition should be highlighted one R&D institute (Teknologisk Institut).

In *Norway,* we find mainly following types of organisations: large incumbent companies (NoI_LC_21, NoI_LC_16), new entrants (NoNE_SME_26, NoNE_SME_57, NoNE_SME_72), one university (No_Uni_1), two R&D institutes

(NoRD_Inst_7, NoRD_Inst_18), a large municipality (No_Munic_10) and a non-governmental organisation (No_NGO_6).

For *Sweden,* we find mainly four types of organisations: universities (Lund tekniska högskola, Kungliga Tekniska Högskolan, Högskolan Dalarna, Uppsala Universitet), firms (Vattenfall R&D AB, Seabased Industry AB) and municipal organisations (Göteborgs gatu, Malmö Stad). In addition can be highlighted other organisations (Test Site Sweden, Almi).

We conclude that in all three countries firms are rather central in the networks, while the role of universities is more central in Denmark and Sweden compared to Norway where R&D institutes play a decisive role. Interesting is the central position of municipal organisations in both Norway and Sweden, and the strong involvement of a NGO in Norway.

5 Reflections of project managers and project participants on their collaborative experiences

Pilot, demonstration and test projects frequently involve collaboration between a quite diverse set of actors. Some of them are private companies interested in exploring commercial opportunities, others are research institutions interested in carrying out novel research or applying research in a more commercial setting and others still are non-governmental organisations (NGO) interested in pursuing certain political goals. In addition to differences in goals, these organisations often vary in size and have different organisational cultures and decision-making processes. Some of them have worked together previously and have an established relationship, while others meet for the first time during the project. These and other factors affect how well the different actors work together and whether the pilot, demonstration or test project becomes successful.

In this chapter, we discuss the reflections of project managers and project participants on their experience of collaborating in such projects. This chapter is based on a range of interviews carried out in Sweden, Denmark and Norway. The interviews were carried out using a semi-structured approach, where the participants were allowed to speak fairly freely about the issues. Nevertheless, an interview guide was used in all the interviews that asked a series of questions about the impact of differences among the participants had on the collaboration in the projects (see 8.1 Annex 1: The interview guide for the interviews with the project managers). The most important questions were about the effects of:

- Differences in educational background among the participants;
- Differences in goals among the participants;
- Differences in size of the participants;
- Differences in location among the participants;
- Unfamiliarity with the other participants.

5.1 Sweden

In Sweden, we have analysed six different projects. For each project the project leader has been interviewed, and in some circumstance other participants have also been interviewed. The following projects where part of the Swedish sample:

- **Project 1** was led by the Business Region Göteborg. The aim of the project was to produce 100 trucks that could run on a mix of diesel and methane and test how they would work in real conditions in the Swedish market.
- **Project 2** was led by Innovatum in Trollhättan. The aim of the project was to develop an electric vehicle prototype that could be demonstrated in Almedalen. In addition, another goal was to create networks for suppliers of electric vehicles and to build this type of competence in Sweden.
- **Project 3** was led by the City of Stockholm. The aim of the project was to build a refuelling station for hydrogen which was to be used for refuelling hydrogen vehicles that they could buy for their own bus fleet.
- **Project 4** was led by the Swedish company Hybricon. The aim of the project was to demonstrate a super rapid charger station that they had developed for the buses. The project involved a set-up of a charger station at Umeå Airport.
- **Project 5** was led by Innventia. The aim of the project was to use Concentrated Hydrocloric Acid Process (CHAP) process in a way that ethanol production could be integrated at a pulp and paper plant.
- **Project 6** was led by Chemrec. The aim of the project was to fund a demonstration plant for gasification of black liquor.

Having participants with similar organisational size or cultures turned frequently out to be an advantage; conversely, having participants with dissimilar organisational size or cultures sometimes posed different types of challenges.

In project 2, the project leader pointed out that one of the participants did not realise the importance of delivering on time, at least partly due to different types of organisational culture. In project 2, there were cultural differences that caused some trouble in the project, between the Swedish partners and EvoBus. The main problem was with data secrecy. The City of Stockholm found it troublesome not to get access to all the data from the (Swedish) project that were collected on bus performance.

Project 1 was considered among the project partners, to be a successful project in terms of cooperation. The project leader pointed out that the size of the different companies had an impact on decision-making. The delays caused by decision-making processes in the larger companies created some frustration among the other actors. Volvo, which was one of the partners in the project, instead explained the difference in time it took for decision-making among the project partners with international ownership and the fact that the project was not part of a continuous development for the gas companies as it was for Volvo.

In the projects involving participants with similar educational background, most participants found that these similarities were an advantage. In project 5, most participants had a similar educational background. Almost everyone were engineers. The level of education was generally high, many have PhDs. The project leader believed that working with engineers made collaboration easier, “we speak the same language”.

In projects where the participants knew each other in advance, most participants considered this to be an advantage; conversely, in projects where the participants did not know each other in advance, most of them said that they had to spend a considerable amount of time building trust and getting to know one another. In project 1, the project leader said that they had a trustful relationship before the project started and that this is important in a project like theirs where the different actors promise to deliver things that the other partners depend on. The fact that they openly shared experiences and knowledge was also positive and could not have happened without this trust.

5.2 Denmark

In Denmark, we have analysed three different pilot, demonstration or test projects. For each project the project leader has been interviewed, and in some circumstance other participants have also been interviewed. The following projects where part of the Danish sample:

- **Project 1** was led by the Danish company Clever. The aim of the project was to let regular Danish citizens test electrical vehicles and collect data on their use of the vehicles.
- **Project 2** was led by the Danish company Movia. The aim of the project was to produce and test two electrical busses in Copenhagen.
- **Project 3** was led by the Danish company Biogasol. The aim of the project was to test out a new production method for biofuels.

In the projects involving participants with different goals, most of the projects found ways to combine these goals and channel them in a joint direction. In project 1, the participants had a diverse set of goals, and the project leader found it challenging to align the interest of all parties.

In projects involving participants with similar organisational size or cultures, most participants considered this to be an advantage; conversely, in projects involving participants with dissimilar organisational size or cultures, most participants found that these differences to pose different types of challenges. In project 3, some difficulties arose because of cultural differences. Among others the engineers in one company used a language that other participants found difficult to understand, and they were also perceived a somewhat arrogant because they left tedious tasks to the others participants.

In the projects involving participants with different educational background, most participants found that these differences could be challenging. In project 3, the participants had quite diverse educational backgrounds. Nevertheless, the leaders in the project were used to dealing with these sorts of projects and were able to ensure a fruitful collaboration. In project 1, the project leader pointed out that the diversity in educational background was only a strength for the project.

In projects where the participants knew each other in advance, most participants considered this to be an advantage; conversely, in projects where the participants did not know each other, most of them said that they had to spend a considerable amount of time building trust and getting to know one another. In project 3, in particular, some of the participants said that they had to spend a considerable time building trust.

5.3 Norway

In Norway, we have analysed six different pilot, demonstration or test projects. For each project the project leader has been interviewed, and in some circumstance other participants have also been interviewed. The following projects where part of the Norwegian sample:

- **Project 1** was led by a Norwegian producer of dairy products, TINE. This project aimed to reduce CO_2 emissions from transportation of goods from TINE to their customers (retailers). And the project consisted of buying four specially adapted transport vehicles from a foreign vehicle manufacturer that were adapted to run on biogas. At that point the vehicles had not been piloted at any large distribution companies.
- **Project 2** was led by the Municipality of Trondheim. It consisted of a collaboration between public and private actors based on a vision of creating the basis for commercial use of taxi service based on electrical vehicles in the Trondheim area. There were six taxis involved in the project.

- **Project 3** was led by the Norwegian company, EV-Power. Within the Norwegian region of Trøndelag a project was carried out based on the theme of interoperability and roaming for el-vehicle users. Their aim was to link together a number of charging points in different regions and make it possible for the consumer to have an agreement with only one supplier, but be billed for usage in other areas.
- **Project 4** was led by the Norwegian company REELYPEM. The aim of the project to develop a new PEM electrolyser to support Utsira with interim storage of energy for their wind power facilities.
- **Project 5** was led by the company ZEG Power. The aim of the project was to build a demonstration plant for a new technology that converted bio-methane into hydrogen and electricity while employing a method for carbon capture. The project aimed at reaching high levels of conversion efficiency.
- **Project 6** was led by the NGO, Zero. The aim of the project was to build a number of fast-charging stations from Oslo to Trondheim. At the time the project was initiated, there was no fast-charging infrastructure in place and few of the electrical vehicles could be charged using this method.

In the projects involving participants with different goals, most of the projects found ways to combine these goals and channel them in a joint direction. In project 6, an NGO led the project. But the NGO found that the commercial possibilities of the project kept the private companies motivated to complete their part of the project and achieve common goals. Nevertheless, in some projects the commercial actors where more risk adverse than the public actors. In project 2, for instance, the taxi companies were very concerned that they would spend a lot of valuable time recharging their vehicles, and the public participants had to spend considerable effort convincing them that the charging infrastructure would both be efficient and reliable.

In projects involving participants with similar organisational size or cultures, most participants considered this to be an advantage; conversely, in projects involving participants with dissimilar organisational size or cultures, most participants found that these differences to pose different types of challenges. In project 1, the project leader was a producer of dairy products and one of the main commercial suppliers a foreign vehicle producer. Nevertheless, the project leader said that they had very similar cultures, in the sense that both were quite specialised within transportation and concerned with vehicle design. In project 6, some of the participants commented that differences in size had a large impact on their collaboration. The largest companies often had very bureaucratic procedures that took a long time, while the smaller participants could make decisions much swifter.

In the projects involving participants with different educational background, most participants found that these differences were both enlightening and challenging. In project 5, one of the participants pointed out that they had technical backgrounds, while one of their collaborators had commercial backgrounds. Nevertheless, they were able to collaborate well because company culture and values were quite similar. Other participants in the same project, pointed out that different background led to some complications. Among others one of the early participants had a background in landscape architecture and the project leader thought that they gave less thought to technical solutions.

In projects where the participants knew each other in advance, most participants considered this to be an advantage; conversely, in projects where the participants did not know each other, most of them said that they had to spend a considerable amount of time building trust and getting to know one another. In project 6, for instance, the NGO leader and one of the commercial participants had not worked together previously. They said that the project would likely have moved ahead faster if they did not have to spend time building a trustful relationship. In other projects, such as project 5, one of the participants commented that it in general was positive for their collaboration that they know each other in advance, but also that the close relationship made them less professional in terms of their different roles in the project – which were supplier and constructor of the demonstration facility.

5.4 Comparative analysis

We have seen from the qualitative analysis that there are several factors that affect the collaboration in pilot, demonstration and test projects. In general, similarities between the participants are favourable. Both similarities in size, organisational culture and educational background were considered to be favourable by most participants. Nevertheless, being dissimilar in some aspects (educational background) does not necessarily hamper the collaboration if the participants could find common ground on other aspects (organisational culture). Generally the most participants found ways of combining different goals. Nevertheless, in some instances the participants had to spend considerable effort to find “common ground,” and move the project forward.

6 The prioritisation of collaboration by the programmes funding demonstration projects

In the focus groups and interviews with programme managers, we addressed how the programme objectives and priorities have been developed, who had been involved and how collaboration and user involvement has been addressed.

6.1 Sweden

In Sweden the coordinators of two programmes were interviewed, both organised under the administration of the Swedish Energy Agency: the Demonstration programme for more efficient biogas production and the Demonstration programme for electric vehicles.

In both programmes, collaboration has not been a top priority but has been regarded as positive. User involvement has been an important priority in both programmes. The range of users is rather broad, encompassing firms, municipal actors, farmers and rental car service providers. Especially interesting was the focus on institutional embedding of the new technology by the Demonstration programme for electric vehicles.

6.1.1 Demonstration programme for more efficient biogas production

The '*Demonstration programme for more efficient biogas production'* is a continuation on a lower level of the former Local Investment Programme (LIP) and the Climate Investment Programme (KLIMP) during the 1990s. The Demonstration programme is administered by the Swedish Energy Agency and was established in 2012.

The Demonstration programme has the objective to support energy technology, which is environmentally friendly but which has not achieved commercial competitiveness yet. The projects should contribute to increased production and deployment of biogas, be favourable for the climate, provide largest possible climate effect in comparison to the received financial support, the solutions should be energy efficient and have potential for technical development and competitiveness. The first criterion is rather easy to measure while the others are more difficult. Therefore, the programme applies the concept of technological readiness levels (TRL). The programme does not finance any research projects, only demonstration projects. The Ministry of Enterprise, Energy and Communications developed the programme priorities in dialog with the Swedish Energy Agency.

Collaboration is not an explicit goal of the '*Demonstration programme for more efficient biogas production'.* Collaboration is regarded as positive but has not become an issue at all for the selection of projects.

It has been decisive to identify possible users of the demonstrated technology since the programme has a focus on increased biogas production and deployment of biogas. There is a broad range of users: from municipalities to single farmers who both produce and deploy biogas. Another criterion for support has been that the technology was ready for commercialisation. In many projects, there were already users for the technology, but the technology required some improvements to get a more efficient process and to reduce emission of methane.

6.1.2 Demonstration programme for electric vehicles

The '*Demonstration programme for electric vehicles'* was established in 2011 by the Swedish Government. The programme is administered by the Swedish Energy Agency. The programme has the long-term vision to replace fossil fuel transport with electrical transport. The programme shall develop knowledge about how the supporting infrastructure should be developed to transform the transport system towards e-mobility (Energimyndigheten, 2011). This is coherent with the overall goal of the Swedish Parliament, Riksdagen, to achieve a fossil free transport sector by 2030 (Johansson and Kågeson, 2013). The programme wants to demonstrate that it is possible today and also economically feasible to deploy e-mobility in services and municipal healthcare. The programme has the following objectives: (1) demonstrate chargeable electrical vehicles and charging infrastructure to support an electrification of the vehicle fleet, (2) identify and eventually eliminate barriers for large-scale introduction of BEVs on the Swedish market, and (3) create an information channel to disseminate relevant research and information regarding e-mobility. The programme does not only cover demonstration of technology but also new business models and economic preconditions for the success of electrical vehicles. The priorities were developed by stakeholders from industry, municipalities and other organisations with interest in e-mobility.

Collaboration has not been a top priority of the programme, however, the programme recommends the applicants from industry to involve researchers from university to increase the research status of the project. Such collaboration has focussed e.g. on business models and less on the technology. Since the universities could receive 100% funding, this collaboration was attractive, but the limited scale has not driven the project costs up. Collaboration between industry and municipal actors has not been that frequent, but the programme will facilitate this in the future.

The programme has a focus on involvement of users and the institutional embedding of the technology. In almost all the projects users have been involved, with the exception of financing models or similar. There is a broad range of users, including companies, municipal actors and car rental services. The programme is very interested in the reactions of the users of EVs, their driving experiences and attitudes. Interviews have been made to identify factors, that influence whether users adopt the technology or not.

6.2 Denmark

In Denmark, the coordinators of three programmes were interviewed: the Energy development and demonstration programme, Green Labs DK and the Test scheme for electrical vehicles. There is considerable attention to collaboration. The attention is to some extent institutionalised and not only an implicit practice or tradition. Political strategies for public-private collaboration and the industry actors and interest organisations reinforce this collaboration focus. User involvement is central in two of the three programmes. However, there are considerable differences regarding the main types of users. While in two of the programmes companies and technology providers are the main users, it is in the third programme primarily the owners and operators of the technology (EVs fleets) that are the central users. Though end-users of the technologies can appear in the projects, it is in general not this type of user that is most systematically and formally involved in the projects.

6.2.1 Energy development and demonstration programme (EDDP)

The '*Energy development and demonstration programme (EDDP)'* was established in 2007. The programme has the following objectives: through support of development, demonstration and market introduction of new energy technology it shall support the energy policy goals about secure energy supply, independence from fossil fuels, climate challenges, cleaner environment and cost efficiency. At the same time, the programme shall strengthen business potentials to achieve growth and employment.

Regarding the prioritisation of collaboration, EDDP prioritises commercialisation of innovative energy technologies. International collaboration and knowledge networks on energy technology are not in themselves a high priority. EDDP has a priority to support collaboration between public and private actors. It contributes to development of strategies for development of effective and environmental friendly energy technologies and systems. The focus on collaboration between public and private actors and commercialisation of energy technology has been supported by the stakeholder organisations of the industry. EDDP has given funding mainly to private firms (in 2014 86% of the budget), universities (12% of the budget) and much less to public agencies (1%) or other actors (3%).

Collaboration is regarded as an advantage by EDDP, but not an outspoken demand. Danish partners are the main contributors in the projects, while foreign partners play only a minor role. Though collaboration does usually not appear as a problem, there have in some cases been registered problems, where projects could not be realised because of differences between the partners regarding project organisation and content of the project. EDDP's prioritisation of collaboration has contributed to development of networks between public and private actors and between private firms. The participation of market oriented companies has often been favourable for achieving market-near learning outcomes compared to 'pure' knowledge institutions.

The involvement of end-users of the technology is not always prioritised. This depends on the technology and possible applications.

6.2.2 Green Labs DK

'Green Labs DK' was established in 2010 to fund test and demonstration facilities for new energy and climate technologies. The facilities shall be used not only by one enterprise but by several enterprises or other technology developers. The facilities shall enable test and demonstration of the technologies under realistic large-scale conditions. They shall build on Danish top expertise and be capable of attracting both Danish and foreign actors.

As EDDP, Green Labs DK has the objective to support Danish energy policy about secure energy supply, independence from fossil fuels, climate challenges, cleaner environment and cost efficiency. At the same time, Green Labs DK shall strengthen business potentials to achieve growth and employment. The programme supports the government's vision that Denmark shall be a 'green technology lab' where green enterprises have the best framework conditions.

The programme prioritises collaboration. The facilities should give access to both Danish and international actors. Public-private collaboration is supported mainly at the level of clusters and not primarily at the level of single actors. Collaboration is prioritised because this can improve the effects of the projects. Therefore, the programme requests joint project proposals from clusters of actors in the same technology field. The ownership of the facilities belongs to non-profit organisations, such as universities or technological service institutes. This contributes to public-private collaboration and facilitates open access by all actors.

User involvement is important in all technology and application areas. Main users are companies and other technology developers, which will use the test and demonstration facilities in their product and technology development.

6.2.3 Test scheme for electrical vehicles

The '*Test scheme for electrical vehicles'* was established as a follow-up of the Energy agreements in 2008 and in 2012 to facilitate a transition towards more sustainable transportation and integration of more wind energy and other types of renewable energy in the electricity systems.

The test scheme has the objective to contribute with new practical experiences with EVs and the related infrastructure. The scheme shall support deployment of EVs as a flexible energy storage medium, which can contribute to a more effective exploitation of fluctuating wind energy. The scheme prioritises projects about practical use or test of electric cars over a longer period of time. The projects shall include fleets of EVs (not just single EVs) and EV fleet owners who operate a number of EVs, such as public authorities, companies or organisations. Regarding infrastructure, the scheme has focus on practical experience build-up, business models, and methods, and rules for the interaction with the electricity system. The scheme supports also projects that do analyses across projects or communicate results to the public.

Collaboration is often an important element of the projects and a precondition for that projects can get funding. The coordinator of the trial scheme assesses that this collaboration strategy has contributed to that a higher number and a broader group of actors have been involved than would have otherwise been the case. The programme coordinator often suggests possible collaboration partners and facilitates the collaboration. Foreign partners are seldom, but not excluded. Public-private collaboration is supported by a.o. politicians, public authorities and actors in the energy sector. In some cases companies do not wish to collaborate avoiding that their knowledge could be transferred to their direct competitors. The development of networks across the projects – both at national and regional level – has proven to be important. Here should also be mentioned the dialog with relevant interest organisations.

User involvement is very important in this programme. It is realised by collaboration with the EV fleet owners and operators, persons responsible for procurement of EVs and charging infrastructure, and municipalities, regional authorities, companies and interest organisations who play a kind of mediator between the technology providers and the end-users. They facilitate the communication with the end-users.

6.3 Norway

In Norway, focus groups with coordinators of four programmes were organised: Enova SF (a public enterprise owned by the Ministry of Petroleum and Energy), the Environmental Technology Financing Scheme, administered by Innovation Norway, the R&D programmes at the Research Council of Norway: former Renergi (finalised) and the ongoing Energix, and Transnova, an agency established by the Ministry of Transport and Communication.

In general, the attention to collaboration is not institutionalised in programme requirements but more a practical means to achieve demonstration project goals. User involvement is central in most of the programmes. However, there are considerable differences regarding the main types of users. The focus on interaction with users varies according to the kind of business that is applying.

6.3.1 Enova SF

Enova SF is a public enterprise owned but the Ministry of Petroleum and Energy, and established in 2001 (Enova, 2014). Enova SF is financed via funds allocated from the Energy Fund, which is based on a small additional charge to the electricity bill. Enova SF aims at securing energy supply with renewable energy and reducing greenhouse gas emissions. The aim is to introduce new technologies in the market by supporting the “first customers”. The priorities of Enova SF were result of political decision and developed in consultation with the Programme board, the funding agencies and the broader business community.

Enova SF uses three criteria for project acceptance: customer involvement, positive cash flow and that the installation will be in operation for at least two years. Enova also prioritise projects with a good potential for technology dissemination internationally. Enova’s focus is on technology, which will help to achieve Norway’s energy and climate targets. Economic growth is just a bi-product of this. It is a requirement for the projects that test facilities are located in Norway, but they can have non-Norwegian partners or owners. It is a requirement that the facility is in Norway, but it may be based on foreign technology. Enova appreciates publishing, but has no requirement for this. It is only required to report on, among others, market diffusion.

Enova SF aims to promote collaboration, and facilitate contact, particularly among SMEs. However, there is no explicit requirements for cooperation, but the ability to complete the project is important.

Enova SF requires user involvement in all projects. Normally, the users should apply for funding, but some industries such as the energy utilities are rather conservative, and therefore technology providers have been accepted as applicants.

6.3.2 Environmental Technology Financing Scheme

The '*Environmental Technology Financing Scheme'* was introduced in 2011 and is administered by Innovation Norway. The programme has a distinct focus on pilot- and demonstration projects for environmental technology. The focus is on the pre-commercial phase and on involving large companies and strong communities. The objective is to extract an environmental benefit and contribute to wealth creation. Wealth creation is the primary goal, while reduction of greenhouse gases is the secondary goal. The priorities of the '*Environmental Technology Financing Scheme'* were a result of lobbying of interested industries, which highlighted that there was a need for pilot and demonstration projects.

The scheme has provided support for different solutions for advanced biofuels, offshore wind, ocean power e.g., but is struggling to get the funding scheme to work properly, because the Public Tax incentive scheme for business R&D (Skattefunn) makes up a good portion of the financial support for R&D businesses receive and additional support on top of this is limited due to the EEA regulations.

Regarding collaboration, the *Environmental Technology Financing Scheme* does not prioritise international projects in comparison to national projects. The most important issue is that there is a demanding customer who wants to deploy the technology, but it is a requirement that the pilot plant is located in Norway and that a significant part of the value creation will take place in Norway. The scheme has not focused on the dissemination of knowledge because companies wish to retain control of their IPR, but there is a requirement for publication of generic information.

In the *Environmental Technology Financing Scheme* the involvement of users is differing. Sometimes the applicant is the user. In any case, it has to be verified that there is a customer who is willing to deploy the new technology.

6.3.3 ENERGIX (former Renergi)

The *Renergi* programme (Clean Energy for the Future) was administered by the Research Council of Norway (RCN). Renergi was RCN's large-scale programme for environment-friendly energy research from 2004 to 2012. Renergi supported a number of demonstration, trial and test centre projects. In 2013, Renergi was followed up by *ENERGIX*, which will span for the next ten-year period.

The objective of Renergi was to coordinate basic and applied research on environmental technologies – such as hydrogen, biofuels and carbon capture and storage (CCS). CCS was spun off in 2009 in the Climit programme. *ENERGIX* has five objectives: sustainable exploitation and use of renewable energy resources; reduction of Norwegian and global greenhouse gas emissions; good national security of energy supply; strengthening of innovation in energy related business; further development of Norwegian energy research; finances and facilitates forums for renewable energy and energy efficiency. ENERGIX administers also nine research centres for environmentally friendly energy (FME) and has been involved in the development of the Energi21 strategy (ENERGI21, 2011).

The programme promotes industrial development in line with national policy goals for sustainability. The programme has also a specific focus on developing and improving the knowledge base, prioritises projects with a good prognosis for completion, and encourages international collaboration within research projects. The programme focuses on early technology readiness levels (TRL) levels, and does not fund pilot and demonstration projects as much as the Renergi programme did. ENERGIX developed the priorities through different arenas: "geographical" dialogue meetings and interviews, and dialogue with companies, research institutions and the Government.

Regarding collaboration, ENERGIX favours cooperation only when this contributes to greater feasibility and national capacity building. That means that collaboration is not a formal requirement, but supported when there is a need for it. Communication is a criterion, but businesses often wish keeping secret some aspects of the technology and retain control of significant intellectual property.

In ENERGIX projects, there is basically no requirement for user involvement, but dialogue with potential users is required. Associated schemes like KPN involve businesses and require co-financing. In these schemes, the users are central.

6.3.4 Transnova

Transnova is a government agency administered by the Norwegian Public Roads Administration and was established in 2009 by the Ministry of Transport and Communications (Transnova, 2014). The parliament allocates funds to Transnova through annual state budget decisions. The main objective is to reduce greenhouse gas emissions from the transport sector in Norway. Transnova awards grants to projects mainly in the pilot- / demonstration phase, which contribute to a transition to sustainable modes of transport. Transnova spend 20 mil. NOK through the *Environmental Technology Financing Scheme*. Transnova arose as a consequence of the national climate compromise (klimaforliket) and the idea that the transport sector had to take their share of the reductions in greenhouse gas emissions. Transnova's aims are linked to national climate targets. Transnova has as long-term goal reducing barriers to reduce greenhouse gas emissions and contributing to knowledge sharing and business development. Transnova has a steering committee with representatives from the business and research communities, but the Ministry approves the priorities and enters it in the annual allocation letter. They are keen to support the areas no one else does.

All projects must contribute to climate targets in Norway, but the projects can be located in another land. Beside the climate targets for the transport system, the focus is on business development and all projects must have a positive effect on business. Some projects need multiple partners while others do not.

Regarding collaboration, Transnova aims for that projects contribute to knowledge sharing. The most important is that projects must have an effect. If the projects can get this alone or in cooperation with national and international partners is secondary. Transnova has collaborated with environmental NGOs and has funded a number of projects with an NGO as a project leader.

Transnova has a focus on the involvement of users. The focus on interaction with users varies according to the kind of business that is applying. Major companies have regular contact with users and would not do anything that they think they cannot capitalize. These companies will have a market for the products that they develop. Small businesses however need to show that they have interested customers.

6.4 Comparative analysis

The comparative analysis of prioritisation of collaboration by the funding programmes has shown some clear similarities, but also some differences. Here we highlight the following issues: (1) the influence of the national innovation system on the national collaboration patterns, (2) the balance between sustainability and competiveness targets, (3) the control of significant intellectual property, (4) user involvement, and (5) the involvement of interest organisations and local authorities or municipalities.

In our comparative analysis we have seen that prioritisation of collaboration is addressed very differently in the three countries. National collaboration patterns are different due to different national innovation systems, such as the balance between universities and R&D institutes, the role of NGOs, the existence of large R&D-based

incumbents or the dominance of SMEs. However, the different involvement of foreign partners seems to be the result of a political prioritisation. Another explanation might be the scarcity of resources.

National funding programmes for demonstration and trial projects for sustainable energy and transport solutions have to balance between two priorities: (1) supporting the transition towards more sustainable solutions and (2) strengthening the competitiveness of national actors. However, the focus on competitiveness is not that strong in the Danish and Swedish programmes as in some of the Norwegian programmes, but there are also differences between the Norwegian support schemes – while Enova has clear climate targets as highest priority, the Environmental Technology Financing scheme has national competitiveness as highest priority and Transnova has a mixture of both.

While transition processes require international collaboration to become successful at a global scale, the national policy focus on competitiveness might hamper international knowledge exchange and by this successful niche up-scaling because the national markets have their limitations. However, we have seen that there are some differences regarding the supported technologies. Support schemes for e-mobility in Sweden and Denmark prioritise e-mobility as a solution for fulfilling climate targets, while in Norway the supported projects have to show as well a positive influence on business.

We have seen that several Norwegian support schemes allow for that companies can retain control of significant intellectual property and have not to disclose significant technology. Similarly, the Danish Test scheme for electrical vehicles has experience with firms which avoid that their knowledge could be transferred to their direct competitors. This makes collaboration difficult.

User involvement is central to all of the funding programmes. However, there are differences related to who the users can be, i.e. the end-users of EVs can be individual customers or fleet owners, the user of a new energy technology can be an electricity facility or a company which is integrating the technology in its operations etc. Therefore it is difficult to draw general conclusions for all types of users.

Another interesting question was if the Scandinavian demonstration projects are based on collaboration between the usual suspects, such as firms and R&D organisations, or if they include as well other types of societal actors, such as NGOs, local authorities or private foundations. Our analysis revealed that only for the Norwegian network NGOs played an important role while municipalities and local authorities were involved actively in demonstration projects in all three countries, but especially in Sweden and Norway. This is confirmed by the SNA results and the feedbacks from projects during data collection. Representatives from Swedish local authorities and municipalities often expressed that it was on local and regional level that the “real” work was done, while the national level and companies followed. The Danish Test scheme for electrical vehicles has a dialog with interest organisations and supports collaborative projects connecting firms with local authorities.

7 Conclusions and policy implications

This report gives results of an analysis of effects of demonstration projects in transition processes to sustainable energy and transport in the Scandinavian countries on the development of knowledge networks and interaction with users, which we assess as two of the main outcomes of demonstration projects. Public funding of demonstration and trial projects are relatively well-developed policy instruments for the transition towards more sustainable energy and transport systems in the Scandinavian countries. However, the three countries have used such instruments to a different extent and with different priorities.

In this report we concentrate on the formation of broad and aligned networks and collaboration patterns, including the involvement of users, both industrial users and customers, and analyse how public agencies prioritise networking and user involvement in their funding programmes of demonstration and trial projects.

We identified 433 demonstration projects starting in the period 2002–12, in Denmark 224 projects, in Norway 107 projects and in Sweden 102 projects. Almost one fourth of the projects targeted road transport solutions, mainly electrical mobility and biofuel/biogas.

The analysis of the project aims revealed rather different priorities between the three countries. Main differences have been identified for the following aims: facilitate learning, formation of knowledge networks, institutional embedding, public acceptance, commercial feasibility and reduction of costs. We concentrated our analysis on the formation of knowledge networks.

We identified 354 connected nodes in the Danish projects, 296 in the Norwegian projects and 170 in the Swedish projects. The comparative analysis of the network patterns revealed clear differences between the three countries regarding the number of projects, number of actors, share of collaborative projects, network density, fragmentation and collaboration with international partners.

International collaboration relations show an unbalanced pattern. Norway has a higher degree of collaboration with foreign organisations, compared to both Sweden and Denmark. Collaboration with Norwegian partners in Swedish or Danish projects is almost not existing, while the opposite is the case for the Norwegian projects.

The comparative analysis of prioritisation of collaboration by the funding programmes has shown some clear similarities, but also some differences. The following issues have been discussed: (1) the influence of the national innovation system on the national collaboration patterns, (2) the balance between sustainability and competitiveness targets, (3) the control of significant intellectual property, (4) user involvement, and (5) the involvement of interest organisations and local authorities or municipalities.

National collaboration patterns are different due to different national innovation systems, such as the balance between universities and R&D institutes, the role of NGOs, the existence of large R&D-based incumbents or the dominance of SMEs. However, the different involvement of foreign partners seems to be the result of a political prioritisation or by different access to funding means.

The Scandinavian funding programmes for demonstration and trial projects for sustainable energy and transport solutions interact with the respective R&D funding programmes. In some cases they are even a part of such programmes. There is also a need for analysing the funding programmes for demonstration and trial projects in interaction with other policy instruments, such as fiscal instruments. This has not been in the focus of this report.

National funding programmes for demonstration and trial projects for sustainable energy and transport solutions have to balance between two priorities: (1) supporting the transition towards more sustainable solutions and (2) strengthening the competitiveness of national actors. However, the focus on competitiveness is not that strong in the Danish and Swedish programmes as in some of the Norwegian programmes, but there are also differences between the Norwegian support schemes.

User involvement is central to all of the funding programmes. However, there are differences related to who the users can be, i.e. the end-users of EVs can be individual customers or fleet owners, the user of a new energy technology can be an electricity facility or a company which is integrating the technology in its operations etc. Therefore it is difficult to draw general conclusions for all types of users.

Scandinavian demonstration projects are often based on collaboration between firms and R&D organisations, but the networks also include other types of societal actors, such as NGOs and municipal organisations. In all three countries, firms are rather central in the networks, while the role of universities is more central in Denmark and Sweden compared to Norway where R&D institutes play a decisive role. Interesting is the central position of municipal organisations in both Norway and Sweden, and the strong involvement of a NGO in Norway. This NGO initiated several demonstration projects.

Pilot, demonstration and test projects frequently involve collaboration between a quite diverse set of actors. Some of them are private companies interested in exploring commercial opportunities, others are research institutions interested in carrying out novel research and others still are non-governmental organisations (NGO) interested in pursuing certain political goals. In addition to differences in goals, these organisations often vary in size and have different organisational cultures and decision-making processes. Some of them have worked together previously and have an established relationship, while others meet for the first time during the project. These and other factors affect how well the different actors work together and whether the pilot, demonstration or test project becomes successful.

We have seen from the qualitative analysis that there are several factors that affect the collaboration in pilot, demonstration and test projects. In general, similarities between the participants are favourable. Both similarities in size, organisational culture and educational background were considered to be favourable by most participants. Nevertheless, being dissimilar in some aspects (educational background) does not necessarily hamper the collaboration if the participants could find common ground on other aspects (organisational culture). Generally, most participants found ways of combining different goals. Nevertheless, in some instances the participants had to spend considerable effort to find “common ground,” and move the project forward.

What are the policy implications? We want to highlight the following policy implications for the funding programmes. The funding programmes should:

- support a number of projects and not just one big project to facilitate the demonstration of several alternative solutions;
- facilitate learning across projects to contribute to knowledge sharing;

- address the need of companies to retain the intellectual property rights in balance with the sustainability targets of the programmes;
- facilitate – when relevant – the dialogue with non-governmental organisations;
- target more institutional embedding of new technological solutions to improve learning about and diffusion of the technology;
- strengthen private-public collaboration, especially at the local level;
- coordinate their efforts at the national level to secure optimal conditions for the supported projects; and
- coordinate their efforts across national borders to achieve stronger and more successful projects and collaboration across the Scandinavian borders.

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Appendix

7.1 Annex 1: The interview guide for the interviews with the project managers

1. Would you please describe the content of the project?

Collaboration
2. According to our information, the following partners were involved: XXXX
Can you explain why each of them were included in the project?
3. Did each of the partners fulfil the role in the project as expected, or did some of them take up different roles than what was expected when they were included in the project?
4. Were some of the collaboration partners more central to the project than other? Who were the central partners?
5. How close contact with the partners did you have throughout the project?
6. Where are the partners located?
[CHECK QUESTION]
Is it in your…
1. Home region
2. Another region in your country
3. Another Scandinavian country
4. Outside Scandinavia

[FOLLOW UP QUESTION]
Did differences in distance between you and the partners impact the collaboration you had with them? Please exemplify?
7. How was contact to the partners initiated?
[CHECK QUESTION]
Did you know all of them well prior to project start?
So would you say that you had trustful relations to your partners when you started the project?
[FOLLOW UP QUESTION]
Did it influence your collaboration positively or negatively that you [knew each other well / didn't know each other] prior to project start? Please exemplify?
8. Generally speaking, would you say that the collaborators in the project were at the same wavelength – do you think in similar ways?
[FOLLOW UP QUESTION]
Did it influence your collaboration positively or negatively that you think in [similar/ somewhat different / very different] ways? Please exemplify?
9. Did the people involved in the collaboration generally have similar educational backgrounds, or was it a very diverse group?
[FOLLOW UP QUESTION]
Did it influence your collaboration positively or negatively that your educational backgrounds were [similar / related / different]? Please exemplify?
10. Generally speaking, would you say that the cultures in the partner organisations, in terms of for instance norms, values and routines, were quite similar or quite different?
[FOLLOW UP QUESTION]
Did it influence your collaboration positively or negatively that the cultural differences were [small / intermediate / large]? Please exemplify?
11. How will you evaluate the contribution of each of the different partners to the project?
[FOLLOW UP QUESTION]
Why, and in which respect?

Expectations
12. What were the objectives of the project?

Were there any expectations to the project not expressed in the objectives at the projects start?

Were these expectations the same across project partners, funding agency and other stakeholders?
13. Did the expectations or the objectives change during the project?

If yes:
- What were the new expectations or objectives?
- Why did expectations or objectives change?

14. Considering the project as a whole, has it fulfilled the objectives that were set at the beginning of the project?

In your opinion, what have been the main factors that have/have not enabled the project to fulfil/not fulfil the expectations and objectives?

In your opinion, was the project successful? In what aspects was it successful?
15. Was the project initiated due to a local, regional, or national vision?
If yes;
How was this reflected in the objectives of the project?
If no;
Are there any scenarios that have had an impact on the project in any way?
16. Were foresighting activities part of the project?
17. Did the project have any impact on local/regional/national visions or scenarios?
If yes;
How?

Learning
18. Would you say that you and your colleagues have learned from your participation in this project?

Can you tell us more about how this happened?
(If they need prompting ask if it was mostly about the technology or if there were other things they now understand better.)

Were there any unexpected problems, which you had to solve?
Can you describe an example?

Are there things you are doing differently now because of your experiences in the project?

Can you explain how the project helped you see things differently?

19. [If they have not already given an example of technical development ask them directly]
Can you give an example of a lesson concerning technical development and infrastructure from the project?

20. [If they have not already given an example relating to users, ask them directly]
Can you give an example of how you learned more about the users and the market through the project?
21. Has the project changed your ideas of the environmental impact or the safety of the product?
Can you explain how you became aware of this?
22. Did the project make you aware of new manufacturing challenges?
Can you give an example?
23. Did the project make you aware of new challenges related to government policy and regulations?
Can you give an example?

24. I there anything else concerning the project that you think would be relevant for us to know?
Thank you for your time!

7.2 Annex 2: The interview guide for the focus groups and interviews with the programme managers

1. Background

What is the background of the programme? Why and how was the programme initiated?

2. Programme priorities

What are the long-term goals or the vision of the programme?
What are the priorities of the programme?
How were these priorities developed?
Are the priorities influenced by government policy, by industry, by research organisations or by other actors?
Which role have demonstration and test projects in the project portfolio of your programme?

3. Project collaboration

Do you prioritize collaboration in the funded demonstration and test projects? Please explain eventual differences regarding national and international collaboration.
Can you explain these priorities (e.g. participation of large companies, SMEs, national or foreign research organisations, industry associations, municipalities or regional authorities, NGOs etc.)?
Can you explain why and how these priorities for collaboration in such projects have been developed? Is this a requirement from industry, science policy or the general public?
How have the involved actors react on these priorities? Do they support these priorities or do they assess them as disadvantageous? Please explain why.
What kind of results has this collaboration strategy implied?
Examples could be networking, learning, involvement of new types of actors etc.

4. User involvement

How important is user involvement in the funded demonstration and test projects? Can you distinguish between different types of technologies or sectors of implementation?
Who are the main categories of users in demonstration and test projects?
Are there differences in user involvement according to different stages of the projects on the way to commercialisation?
Does your programme allow user input to improve the funded demonstration and test projects?

5. Project design and planning

Does the programme allow modifications to improve effectiveness of funded demonstration and test projects?
How do you assess market readiness and user involvement in funded projects?
How do you consider the required size of the demonstration and test projects?
Do you include dissemination of results and evaluation information in the project design? Can you explain?
Do you include performance monitoring, maintenance and trouble-shooting in the projects since they are important for learning?

6. Monitoring and evaluation

How do you monitor and evaluate the demonstration and test projects?
How do you evaluate the outcomes of the demonstration project? Do you distinguish between tangible and intangible outcomes?
Do you analyse intended and unintended effects and long-term impacts of trial and demonstration projects?
How do you organise the feedbacks from the project participants and involved users?

7. Maturity of technology

How do you ensure that the programme does not subsidise demonstration projects and trials of already mature technology?

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